PART I.] [PRICE 3*s*.

A

SYSTEM OF SURGERY,

BY

J. M. CHELIUS,

Doctor in Medicine and Surgery, Public Professor of General and Ophthalmic Surgery, Director of the Chirurgical and Ophthalmic Clinic in the University of Heidelberg, &c., &c., &c.

TRANSLATED FROM THE GERMAN,

AND

ACCOMPANIED WITH ADDITIONAL NOTES AND OBSERVATIONS,

BY

JOHN F. SOUTH.

Surgeon to St. Thomas's Hospital.

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INTRODUCTION.

I.

DEFINITION OF SURGERY.—ITS RELATION TO THE HEALING ART IN GENERAL.—DIVISION OF SURGICAL DISEASES.

ALL diseases to which the animal organism is exposed, are the object of the science of healing, the purpose of which is their *prevention*, *cure*, *or alleviation*. The means we employ to these ends are either *dietetic* or *pharmaceutic*, or they consist in the *application of suitable mechanism*, which we call *surgical means*, and the doctrine of their proper employment, which is called *surgery*.

Every mechanical influence employed with skill upon the diseased organism is called a *surgical operation*. This influence consists either in a direct interference with the form and natural connexion of the part (*Bloody operations*, Akiurgie (*a*), Germ.); or only in a momentary or continued application of mechanism fitted to the surface of our bodies; to which belong *bandages* and *machines*, simple manipulations for restoring the natural position of parts, and the employment of suitable mechanism for repairing parts which have been destroyed (*Kosmetik* (*b*), Germ.)

There are diseases which specially require the employment of one or other class of the means just mentioned: the purpose, however, of the healing art is in most cases but imperfectly attained, if the medical man be not possessed of the requisite knowledge for deciding upon the necessary connexion of these means, so as properly to conduct their operation by a sufficient acquaintance with the laws of our organism, whence it necessarily follows that there cannot be established any true separation between the so-called *medical* and *surgical* treatment.

The employment of surgical means calls for peculiar dexterity and aptness which natural talents and disposition and long practice can alone confer. "*Esse autem chirurgus debet*," says CELSUS (*c*), "*adolescens, aut certè adolescentiæ propior, manu strenuâ, stabili nec unquam intremiscente, eâque non minus sinistrâ quam dextrâ promptus, acie oculorum acri clarâque; animo intrepidus, immisericors, sic, ut sanari velit eum, quem accepit, non ut clamore ejus motus, vel magis, quam res desiderat, properet, vel minus, quam necesse est, secet; sed perinde faciat omnia, ac si nullus ex vagitibus alterius affectus oriretur.*" Only in reference therefore to the physical and psychical characters of the medical man, can there be any division in the practice of medicine and surgery: in their attainment they cannot be separated, and, by the union of medical and surgical study alone, can the foundation be destroyed upon which so much bungling, and so many practices unworthy of the spirit of high art, have hitherto been supported.

(*a*) Ἀκή, the edge of a knife; ἔργον, an operation.
(*b*) Κοσμέω, to set in order.
(*c*) De Medicinâ, præf. ad lib. vii.

The study and practice of Surgery are connected with great difficulty. The dexterity and exactitude with which surgical operations must be performed, can only be attained by long practice on the dead body, the opportunity for which is rare; and still rarer the perseverance necessary to overcome the various disagreeables therewith connected. How much does this practice on the dead body still leave imperfect when we have to meet operations on the living! In how many instances does the life of the patient depend momentarily on the hand of the operator; the restlessness of the patient, his cries, a peculiar sensation to which no practitioner is a stranger in operating on the living subject, and particularly in the beginning of his career, easily disturb his needful equanimity, render him anxious and incapable of perfecting his work with firmness and certainty. Therefore are we not surprised on reading the open confession of the great HALLER. "*Etsi chirurgiæ cathedra per septemdecim annos mihi concredita fuit, etsi in cadaveribus difficillimas administrationes chirurgicas frequenter ostendi, non tamen unquam vivum hominem incidere sustinui, nimis ne nocerem veritus.*"

In the employment of surgical means the practitioner can only be guided by the most perfect anatomical knowledge. That knowledge of the structure of our body, with which the general practitioner is content, is insufficient for the operator. He must be most intimately acquainted by careful dissection with the position of every part, its relations to others, and the variations which in this respect may occur, so that this definite knowledge may direct him in every moment of an operation. Mere descriptive anatomy is not sufficient for the surgeon without that comparative anatomy which is directed to physiology, and which has in view the early developmental periods of the several organs, by which alone a true insight into the nature of so many diseases is possible.

All these difficulties connected with the acquirement and practice of Surgery, are sufficiently rewarded by the great superiority which, on the other hand, the practice of them offers. In most cases where surgical assistance is necessary, the possibility of preserving the patient depends upon it: we must, therefore, in desperate cases take bold measures, and the advance of Surgery within the last few years in this respect, has raised our astonishment at the heroism of art, as well as at the immeasurable resources of nature. In this point of view has MARCUS AURELIUS SEVERINUS most correctly entitled his book on surgical diseases, *De Medicinâ Efficaci*.

The inadmissibility of dividing Medicine from Surgery is most palpable, when we endeavour to determine the object of the latter, and the diseases comprehended within its boundaries, as it never can have a perfectly determined limit in opposition to the other. All diseases which are cured by the application of mechanical means have been called surgical diseases, a definition at once too narrow and too comprehensive, as many so-called medical diseases are removed only by the application of surgical means, and many diseases are evidently within the jurisdiction of Surgery, which very often can be cured only by internal or external pharmaceutical means. The distinction between external and internal diseases, which has been established as the ground of division between Surgery and Medicine, is entirely without meaning.

Let us endeavour to find out some general characters of disease which to a certain extent might legally serve as the law for a nosological divi-

sion, and to distinguish those diseases to which we would assign the name of surgical.

As the phenomena of life present to us by the relative predominance of *powers and organs*, a *dynamic*, *potential*, and *organic material phase*, on the intimate harmony of which health depends, so do we observe also in the diseased states of the organism, that sometimes the power, sometimes the organ, varies more from the natural type, whence arises the difference between *dynamic* and *organic diseases*. This distinction can, however, only indicate a relatively predominant suffering of one or other phase of life, since the organic body presents in itself an entire whole, of which the several parts and phenomena are in the closest mutual connexion with each other.

The organic diseases are especially those which originate in a destruction of the natural condition, form, and structure of organized tissues, and therefore may generally depend, 1. *on the disturbance of organic connexion;* 2. *on the unnatural union of parts;* 3. *on the presence of foreign bodies;* 4. *on the degeneration of organic parts, or on the production of new structures;* 5. *on the entire loss;* and, 6., *on the superfluity of organic parts.*

Organic diseases must be distinguished into such as have their seat in parts inaccessible to mechanical contrivances, and to our organs of touch, and whose cure therefore can only be attempted by dietetic and pharmaceutic remedies, or whose seat permits the employment of external means and regulated contrivances, and which in most cases can be brought to heal only by these contrivances, with the assistance of dietetic and pharmaceutical aids. *We may therefore distinguish as belonging to the province of Surgery all those organic diseases which have their seat in parts accessible to our organs of touch, or which allow of the employment of mechanical means for their cure.*

Although inflammation is excluded from this general definition, we must, however, still enumerate it generally, and particularly among the manifold origins of surgical diseases, when it attacks external parts. Inflammation in its course and results produces for the most part organic changes, and requires, when attacking external parts, almost always the employment of the so-called surgical means: further, among the surgical diseases soon to be more particularly described, there is not one of which the cause is not inflammation, which in its course does not produce inflammation, or the cure of which is not to a certain extent singly and alone possible by inflammation.

After these observations, we therefore prefer the following division for the setting forth of surgical diseases, which, if it be open to many objections, is, however, an arrangement of diseases according to their internal and actual agreement:—

I. Division.—*Of inflammation.*

1. *Of inflammation in general.*
2. *Of some peculiar kinds of inflammation.*
   a. Of erysipelas; *b.* Of burns; *c.* Of frost-bite; *d.* Of boils; *e.* Of carbuncle.
3. *Of inflammation in some special organs.*
   a. Of inflammation of the tonsils; *b.* Of the parotid gland; *c.* Of

the breasts; *d.* Of the urethra; *e.* Of the testicle; *f.* Of the muscles of the loins; *g.* Of the nail-joints; *h.* Of the joints, viz. a. of the synovial membrane; b. of the cartilages; c. of the joint-ends of the bones, viz., *aa.* in the hip-joint; *bb.* in the shoulder-joint; *cc.* in the knee-joint; and so on.

II. Division.—*Diseases which consist in a disturbance of physical connexion.*

I. *Fresh solutions of continuity.*
A. Wounds; B. Fractures.

II. *Old solutions,*
A. Which do not suppurate, viz.
a. False joints; *b.* Hare-lip; *c.* Cleft in the soft palate; *d.* Old rupture of the female perineum.
B. Which do suppurate, viz.

i. *Ulcers.*
1. In general.
2. In particular.
a. Atonic; *b.* Scorbutic; *c.* Scrofulous; *d.* Gouty; *e.* Impetiginous; *f.* Venereal; *g.* Bony ulcers or caries.

ii. *Fistulas.*
a. Salivary fistula; *b.* Biliary fistula; *c.* Fæcal fistula and artificial anus; *d.* Anal fistula; *e.* Urinary fistula.

III. *Solutions of continuity by changed position of parts.*
1. Dislocations; 2. Ruptures; 3. Prolapses; 4. Distortions.

IV. *Solutions of continuity by unnatural distension.*
1. In the arteries, aneurisms; 2. In the veins, varices; 3. In the capillary-vascular system, teleangiectasis.

III. Division.—*Diseases dependent on the unnatural adhesion of parts.*

1. Anchylosis of the joint-ends of bones; 2. Growing together and narrowing of the aperture of the nostrils; 3. Unnatural adhesion of the tongue; 4. Adhesion of the gums to the cheeks; 5. Narrowing of the œsophagus; 6. Closing and narrowing of the rectum; 7. Growing together and narrowing of the prepuce; 8. Narrowing and closing of the urethra; 9. Closing and narrowing of the vagina and of the mouth of the womb.

IV. Division.—*Foreign bodies.*

1. *Foreign bodies introduced externally into our organism.*
a. into the nose; *b.* into the mouth; *c.* into the gullet and intestinal canal; *d.* into the wind-pipe.

2. *Foreign bodies formed in our organism by the retention of natural products.*
A. Retentions in their proper cavities and receptacles.
a. Ranula; *b.* Retention of urine; *c.* Retention of the fœtus in the womb or in the cavity of the belly (Cæsarean operation, section of the pubic symphysis, section of the belly).
B. Extravasation external to the proper cavities or receptacles.
a. Blood swellings on the heads of new-born children; *b.* Hæmatocele; *c.* Collections of blood in joints.

3. *Foreign bodies resulting from the accumulation of unnatural secreted fluids.*
   a. Lymphatic swellings; *b.* Dropsy of joints; *c.* Dropsy of the bursæ mucosæ; *d.* Water in the head, spina bifida; *e.* Water in the chest and empyema; *f.* Dropsy of the pericardium; *g.* Dropsy of the belly; *h.* Dropsy of the ovary; *i.* Hydrocele.
4. *Foreign bodies produced from the concretion of secreted fluids.*

V. Division.—*Diseases which consist in the degeneration of organic parts, or in the production of new structures.*

1. Enlargement of the tongue; 2. Bronchocele; 3. Enlarged clitoris; 4. Warts; 5. Bunions; 6. Horny growths; 7. Bony growths; 8. Fungus of the dura mater; 9. Fatty swellings; 10. Encysted swellings; 11. Cartilaginous bodies in joints; 12. Sarcoma; 13. Medullary fungus; 14. Polyps; 15. Cancer.

VI. Division.—*Loss of organic parts.*

1. *Organic replacement of already lost parts*, especially of the face, according to the Tagliacozian and Indian methods.
2. *Mechanical replacement:* Application of artificial limbs, and so on.

VII. Division.—*Superfluity of organic parts.*

VIII. Division.—*Display of the elementary management of surgical operations.*

General surgical operations: Bleeding, cupping, application of issues, introduction of setons, amputations, resections, and so on.

II.

HISTORICAL SKETCH OF SURGERY.

First period... to the time of Hippocrates.
Second period. from Hippocrates to Galen.
Third period.. from Galen to the fifteenth century.
Fourth period. the sixteenth century to the middle of the seventeenth.
Fifth period.. the second half of the seventeenth century to the present time.

The origin of Surgery is founded on the relation of man to external nature, and on his disposition to alleviate the sufferings of his fellow men. In ancient Egypt and Greece the history of Surgery lies in darkness, and it begins in a special sense with Hippocrates, who collected the previously scattered facts, arranged them, and published rational views, drawn from his own experience. It appears from his writings—*καθ' ἰητρεῖον—περὶ αγμῶν—περὶ τῶν εν κεφαλῇ τρωματων—περὶ ἄρθρων—περὶ ἑλκῶν—περὶ ϛυρεγγῶν*—that he was acquainted with a copious apparatus of instruments and bandages, and several operations exhibit an actual technical tendency. In different parts of his Aphorisms he treats of surgical subjects.

In the Alexandrian school Surgery became more prominent, as it rested on its proper basis, anatomy. ERISISTRATUS and HEROPHILUS made the first examinations of human bodies. We know of their followers and their performances only from subsequent writers

AURELIUS CORNELIUS CELSUS is the sole writer after HIPPOCRATES (a period of 400 years intervening between them.) Although CELSUS lived at Rome, his writings for the most part belong to the Greeks. In his seventh book he specially treats of surgical operations. After CELSUS deserve to be mentioned SORANUS, ARCHIGENES, and RUFUS.

CLAUDIUS GALENUS, born A.D. 131, lived at Rome under the Emperor MARCUS AURELIUS: such of his writings as treat of Surgery are, for the most part, commentaries on those of HIPPOCRATES—as his Ὑπόμνηματα τρία εἰς τὸ βιβλιον Ἱπποκράτους κατ' ἰητρεῖον—αὐτα περὶ ἀγμῶν—ὑπόμν. τέσσαρα ἄρθρων—ὑπόμν. εἰς τοὺς ἀφορισμους. Besides which also his own Treatises, περὶ τῶν ἐπιδεσμων—περὶ βδέλλων, ἀντιςπάσεως; σικύας, και ἐγχαράξεως καὶ καταςκασμου—περὶ τῶν παρὰ φὺσιν ὄγκων—and θεράπευ τικης μέθοδου βιβλίον. After GALENUS there is a complete stand-still, and up to the sixteenth century there are but few writers: ORIBASIUS, AETIUS, ALEXANDER of Tralles, and PAULUS of Ægina.

With the fall of the Roman Empire and the invasion of the Arabs, came a period of darkness and barbarism. We find Surgery, at this time, in the hands of the Arabian physicians, characterized by the neglect of anatomy, with a copious instrumental apparatus, fear of the knife, and frequent employment of the cautery iron. The most remarkable men of this period were EBN SINA and ABULCASEM.

The practice of Medicine and Surgery was, during this time, in Christian Europe, in the hands of the clergy, and sank down to such imperfection, that the knowledge of operations, possessed by the Greeks, was no longer to be met with. In the twelfth and thirteenth centuries, indeed, art and science raised themselves by the foundation of literary institutions; but, as their most special object was the education of ecclesiastics, there was little gain to Surgery. The latter was, at a subsequent period, completely separated by two decrees of the Pope from Medicine, and the priests were forbidden *every bloody* operation on pain of excommunication. At this time arose the barbery system, under which the barbers of the priests were employed by them for the performance of the lesser operations of Surgery. In Italy alone was there yet any striving towards improvement, and Surgery still partially remained in the hands of better practitioners.

In the year 1311 PITARD, of Paris, collected the Surgeons into a company, which formed itself into a college; but, owing to the long-continued disputes with the medical faculty, and without advance in anatomy, Surgery remained in its restricted condition.

[During a large portion of the fourteenth century flourished in England JOHN OF ARDEN, who was born in 1307, and certainly lived till after 1377, as, in a manuscript (MSS. Sloane, No. 75, in Brit. Mus.) which, he says, "propriâ manu meâ exaram," he declares himself 70 years old, "regni regis Richardi 2^{di} primo." From examination of his works, written in Latin, several manuscripts of which, together with many English translations in MSS. of the whole or part of his works, are in the library of the British Museum and in the Bodleian Library at Oxford, it is probable that he did not know much about anatomy, though perhaps

he was not more ignorant than his contemporaries. But he was certainly an attentive observer and a careful recorder of what he saw. He wrote specially upon anal fistula, which was translated by READ in 1588, and also a Practice of Surgery, in which, among other things, he speaks of sores on the penis, also of gonorrhœa, and describes what is to be done when a stone gets into the urethra. From the number of manuscripts and translations it is quite evident he was long held in great repute by his countrymen, and his works are quite equal and much more original than those of surgical writers of the early part of the sixteenth century. It is much to be regretted that the several manuscripts have not hitherto been collated and published, as they present an excellent view of the state of Surgery in England at this period.—J. F. S.]

With GUIDO DE CHAULIACO (who lived at Avignon) first commenced a period of independent exertion and reference of Surgery to the basis of anatomy.

[In 1542 the Surgeons, who had previously existed in London as one if not two distinct bodies or brotherhoods, were united without any very good reason beyond, perhaps, HENRY THE EIGHTH'S pleasure, by act of Parliament, to the Barbers' Company of London; but they were only paired, not matched, as it appears that their Court of Assistants was equally divided between the two professions, the Barbers having their side, the Surgeons theirs, but neither interfering with the other's department. This Act of Parliament encouraged dissection by directing that "the masters or governors of the said mystery" should have, "at their free liberty and pleasure," the bodies of four felons, "to make incision of the same * * * for their further and better knowledge, instruction, insight, learning, and experience in the said science or faculty of Surgery." From the destruction of the books it cannot be ascertained whether dissection was forthwith pursued; but, in 1566, public demonstrations and dissections were enacted by the Company of Barbers and Surgeons to be held in their hall at stated periods, and conducted by two masters and two stewards of the "anathomies." There was also a readership of anatomy at the hall, which was long held by physicians appointed by the Court of Assistants, but when instituted is doubtful. WADD says that Dr. WILLIAM CUNNINGHAM lectured there in 1563; but the first appointment I can find is that of Dr. PADDY, who was appointed reader of the anatomy lectures on the 11th July, 1596.

The study of anatomy does not seem to have been so little thought of at this time as generally believed, in proof of which it may be mentioned that Sir EDWARD ARRIS, an alderman of London, who was also warden in 1642, and master of the Company of Barbers and Surgeons in 1651, founded on the 27th October, 1645, six anatomical lectures, to be publicly read every year between Michaelmas and Christmas, and endowed them with 300*l.*, on condition that the Company should pay for the lectures 20*l.* a-year: subsequently he exchanged this sum for an annuity of 30*l.* charged on his estates, and at a later period redeemed this charge by paying 510*l.* to the Company, which was by them paid over at the dissolution to the Surgeons' Company, and, when the latter merged into the College of Surgeons, the same was handed over to them. ARRIS's good example was followed by Mr. JOHN GALE, who, on the 30th June, 1698, founded one anatomy lecture every year, to be called GALE's Anatomy, and endowed it with a rent-charge of 16*l.* a-year out of certain landed pro-

perty, which was subsequently sold for 432*l.* sterling, and the interest thereon now produces rather more than 20*l.* The two endowments are now consolidated, and the lectures on human anatomy and Surgery are called ARRIS's and GALE's Lectures.—J. F. S.]

In this way, assisted by the advance of anatomy, was Surgery raised, by PARÉ, FRANCO, FABRICIUS HILDANUS, FABRICIUS AB AQUAPENDENTE, SEVERINUS, and WIESEMANN, in the sixteenth century, to a high station.

In the second half of the sixteenth century actually commences the brilliant period of Surgery. Numerous wars and the establishment of public hospitals presented a rich field for observation, and the foundation of the Academy of Surgery at Paris collected scattered powers and aroused a general emulation. In France shone out DIONIS, J. L. PETIT, MARESCHAL, QUESNAY, MORAND (*a*), LOUIS, LEDRAN, GARENGEOT, LAFAYE, LECAT, LAMOTTE, RAVATON, DAVID, POUTEAU, LEVRET, SABATIER, DESAULT; in England, WISEMAN, CHESELDEN (*b*), DOUGLAS, the two MONROS, SHARP, COWPER, ALANSON, POTT, HAWKINS, SMELLIE, and the two HUNTERS; in Holland, ALBIN, DEVENTER, CAMPER; in Italy, MOLLINELLI, BERTRANDI, MOSCATI, SCARPA; in Germany, HEISTER, PLATTNER, BILGUER, BRAMBILLA, THEDEN, RICHTER, C. SIEBOLD, and MURSINNA.

By this general cultivation has Surgery been brought up in modern times to an elevation which cannot be displayed generally but only in the history of the several operations. Boldness grounded on the progress of anatomy and physiology, simplicity in the methods of treatment, and scientific culture, distinguish it.

The equal participation of all civilized nations in these efforts keeps up amongst them a contest for intellectual superiority in the ranks of improvement, while it makes any decisive award impossible.

(*a*) He was Secretary to the Academy of Surgery, and, on the opening of the schools in 1743, delivered a most admirable address, "Discours dans lequel on prouve qu'il est nécessaire au Chirurgien d'être lettré," in which he shows the necessity of a literary education for a Surgeon, and mentions incidentally that the royal declaration founding the Academy, required "that the Surgeons of Paris should be Masters of Arts before admission into the community, and that they should then pursue Surgery without mixing any mechanics," "loi précieuse," says he, "qui, faisant une des époques les plus mémorables pour l'illustration de notre art, doit immortaliser celui (DE LA PEYRONIE) qui la sollicitée et dont les titres éminens sont soutenus par un mérite supérieur." *Opuscules de Chirurgie*, p. 118. Paris, 1768. 4to.

(*b*) He established the first School of Anatomy in London, independent of the Barbers' and Surgeons' Company, at St. Thomas's Hospital about the year 1714.

III.

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OF INFLAMMATION.

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1. INFLAMMATION (*Inflammatio*, *Phlogosis*, Lat.; *Entzündung*, Germ.; *Inflammation*, Fr.) is that condition of an organized part in which the vital process and plasticity of the blood are unnaturally raised, and which is manifested by pain, redness, increased temperature, and swelling.

The elevation of the vital process must be of a certain duration and intensity, that is it must be actually diseased, when we apply to it the name *Inflammation*. Thereby, alone is inflammation distinguished from the temporary condition of *active congestion* and increased *turgor vitalis*. The proximate cause of these phenomena is indeed the same as in inflammation, and may run into it. The same applies to the so-called inflammatory irritation.

[The term "inflammation" has been objected to by ANDRAL (*a*), one of the most able French writers on pathology. He says:—"Created in the infancy of science, this expression, (inflammation,) completely metaphorical, was destined to represent a morbid condition, in which parts seemed to burn, to inflame, as if they had been subjected to the action of fire. Received into the language, without any precise idea having ever been attached to it, under the triple relation of symptoms which announce it, of lesions which characterize it, and of its actual nature, the expression "inflammation" has become so vague, and its interpretation so arbitrary, that it has really lost all value: it is like a piece of old money without the impress, which must be put out of circulation, as it causes only error and confusion. Inflammation can only be considered as the expression of a complex phenomenon, comprehending many other phenomena, the dependence of which is neither necessary nor constant." (vol. i. p. 9.) He has, therefore, chosen to set aside the term "inflammation" as generally characterizing the phenomena we are about to consider, and has employed that of "hyperæmy," restricting it, however, only to that condition of the vessels in which they are loaded or congested with blood, from whatever cause, healthy or unhealthy, such condition may arise. JOHN HUNTER (*b*) seems to have anticipated these objections; for, he observes:—"The term or idea of inflammation may be too general, yet it is probable that it may form a genus, in which there is a number of species, or it may be more confined in its classification, and be reckoned a species containing several varieties. These are, however, so connected among themselves, that we cannot justly understand any one of the species or varieties without forming some idea of the whole, by which means, when treating of any one, we can better contrast it with the others, which gives us a clearer idea, both of the one we are treating of, and of the whole." (p. 265.) The difficulty, however, is to distinguish the onset of the diseased action, inflammation, from the natural one, congestion or turgescence. Their close resemblance was first pointed out by HUNTER, who observes:—"The very first act of the vessels when the stimulus which excites inflammation is applied, is, I believe, exactly similar to a blush. It is, I believe, simply an increase or distension beyond their natural (ordinary?) size. This effect we see takes place on many occasions: gentle friction on the skin produces it; gently stimulating medicines have the same effect; a warm glow is the consequence similar to that of the cheek in a blush: and, if either of these be increased or continued, real inflammation will be the consequence." (p. 279.) So ANDRAL:—"Will anatomy establish any line of demarcation between physiological (healthy) and pathological congestion? No more than the latter can always be strictly separated from the complex phenomenon called "inflammation." Thus, under the influence of violent emotion, vessels appear on the conjunctive coat of the eye, and the lids become red. The same effect follows a grain of sand falling on the front of the eye; insensibly does the congestion increase from that almost normal condition in which vessels appear on the conjunctive coat to that when the mucous membrane of the eye, becoming uniformly red and considerably swelled, presents that variety of opthalmy known as *chemosis*." (vol. i. p. 13.) The same language is held by MULLER (*c*):—"Inflammation begins, indeed, with phenomena which are similar to turgescence. The organs attract more blood than usual, in consequence of the altered affinity between the blood and the tissue, and obstructs its efflux; but we must be very cautious in calling increased vital action that important change caused by inflammatory irritation which produces functional disturbance, and has consequent to it an effort of nature to compensate an injury which has interfered with the action of the organ. Had the vital action been increased, so would not the morbid processes of inflammation have occurred." (vol. i. p. 218.) HUNTER also observes:—"Though pure inflammation is rather an effort of nature than a disease, yet it always implies disease or disturbance, inas-

(*a*) Précis d'Anatomie Pathologique. (*b*) On the Blood, Inflammation, &c.
(*c*) Handbuch der Physiologie des Menschen.

much as there must be a previous morbid or disturbed state to make such effort necessary." (p. 260.) Again:—"Inflammation is to be considered only as a disturbed state of parts which require a new but salutary mode of action to restore them to that state wherein a natural mode of action alone is necessary: from such a view of the subject, therefore, inflammation in itself is not to be considered as a disease, but as a salutary operation, consequent either to some violence or some disease." (p. 249.) "Inflammation is not only occasionally the cause of diseases, but it is often a mode of cure, since it frequently produces a resolution of indurated parts, by changing the diseased action into a salutary one, if capable of resolution." (p. 250.) "Inflammation may first be divided into two kinds as first principles, viz., the healthy and the unhealthy. The healthy probably consists only of one kind, not being divisible but into its different stages, and is that which will always attend a healthy constitution or part, is rather to be considered as a restorative action than a diseased one, and would rather appear to be an effect of a stimulus than an irritation. The unhealthy admits of vast variety, (diseases being almost numberless,) and is that which always attends an unhealthy constitution or part, but principally according to the constitution: however, many parts naturally have a tendency to run into inflammations of particular kinds.* * The simple act of inflammation cannot be called specific, for it is an uniform or simple action in itself; but it may have peculiarities or specific actions superadded. Inflammation is either single or compound: it may be called single when it has only one mode of action in the part inflamed, as in its first stages; compound, when attended with another mode of action, or when it produces other effects." (p. 251.)]

2. All organs of the body may become inflamed except the cuticle, hair, and nails. The disposition to become inflamed depends on the number of nerves and capillary vessels in a part. The actual seat of inflammation is always the capillary-vascular system, and the ganglionic-nervous system, accompanying the most delicate branches of the vessels, which specially presides over vegetation in the organism.

["Inflammation," says HUNTER, "may arise from very different causes, and often without any apparent cause, and its operations are far more extensive than simply the act of producing union in parts divided by violence." (p. 248.) "Susceptibility for inflammation may be said to have two causes—the one original, the other acquired. The original constitutes a part of the animal economy, and is probably inexplicable. Of the acquired, it is probable that climate and modes of life may tend considerably either to diminish or increase the susceptibility for inflammation. The influence, however, of climate may not be so great as it commonly appears to be; for it is generally accompanied by modes of life that are not suited to others." (p. 226.) "Inflammation, when the constitution is strong, will be commonly the most manageable, for strength lessens irritability; but in every kind of constitution inflammation will be the most manageable where the power and the action are pretty well proportioned; but, as every part of the body has not equal strength, these proportions cannot be the same in every part of the same constitution. According to this idea of strength, the following parts—viz., muscles, cellular membrane, and skin,—and more so, in proportion as they are nearer to the source of the circulation—will be most manageable in inflammation and its consequences, because they are stronger in their powers of action than the other parts of the body. The other parts, as bone, tendon, ligament, &c., fall into an inflammation, which is less in the power of art to manage, because, though the constitution is good, yet they have less powers within themselves, and therefore are attended with the feeling of their own weakness; and I believe they affect the constitution more readily than the former, because the constitution is more affected by local disease, when the parts have less power within themselves of doing well; and the effects, if bad on the constitution, reflect a backwardness on the little powers they have. * * * The inflammation, if in vital parts, will be still less manageable; for, although the parts themselves may have pretty strong powers, yet the constitution and the natural operations of universal health become so much affected, that no salutary effect can so readily take place, and therefore the disease becomes less manageable. * * * In weak constitutions, although the inflammation be in parts which admit of the most salutary operations, in the time of the disease, and in situations the most favourable to restoration after disease, yet the operations of inflammation are proportionably more backward as to their salutary effects in such constitutions, and more or less, according to the nature of the parts affected." (pp. 228, 9.)]

3. Inflammation always commences with a more or less intense pain; the sensibility of the part is increased, redness soon follows, and blood appears in vessels where previously it had not been observed; the temperature of the part is raised, its functions disturbed, secretion suppressed, (at least at first,) or changed, perspiration diminished, and the part swelled. These appearances are developed, in different proportions, to a higher degree, in which fever (*Febris inflammatoria secunda*) usually becomes connected with them.

[I apprehend it would be more correct to say that "inflammation, from its very commencement, is always accompanied with a more or less intense pain," than to say, with our author, it "always commences with a more or less intense pain;" inasmuch as, though that by which the patient's attention is first excited, yet it is only an indication of a disturbance set up in the economy, and which, as it becomes greater, renders itself apparent to the eye, most commonly by redness.—J. F. S.

Dr. ALISON (*a*) observes:—"In order to give the requisite precision to the general notion of inflammation as a local change of the condition of any part of the body, it seems only necessary to include in it, besides the pain, swelling, heat, and redness, the tendency always observed, even when the changes in question are of short duration, to effusion from the blood-vessels of some new products; speedily assuming in most instances the form either of coagulable lymph or of purulent matter." (vol. i. p. 53.)]

4. The pain depends on the increased activity of the nerves (1), and this again produces the succeeding increased influx of the blood, and the vital expansion of the vessels (2); afterwards the pain is increased by the decided expansion and tension which the part suffers. It differs according to the degree of inflammation and the sensibility of the affected part: often it consists only in the sensation of prickling, itching, tickling, and a troublesome stretching; often is it stabbing, tearing, burning, and, in structures largely supplied with nerves, it attains a most vehement degree (3).

The redness, heat, and swelling, depend on the increased action of the nerves and capillary vessels, and is in immediate relation with the richness of their ramifications. Hence the various degrees of redness, heat, and swelling, according to the degree of inflammation and the organs therewith affected. At the onset of the inflammation the swelling always depends on an increase of blood. The reddening of the blood (4) and evolution of warmth are attributes of the living process: they must, therefore, be also increased by its greater activity. According, however, to experiments with the thermometer, the warmth in inflamed parts is not so considerable as to our touch it seems to be (5). Where the most delicate branches of the capillary-vascular system anastomose to form the transition into the veins, several capillary vessels always open together into one single vein. By this disposition of the capillary-vascular system there is already in the healthy state a slower motion of the blood, which is in close relation to the functions of the capillary-vascular system. If, then, in inflammation there be an additional influx of blood, there must arise with the *increased activity* of the capillary-vascular system and vital expansion (6) an accumulation of it, (the blood,) as the veins are not in a condition to take up and carry away with equal readiness the blood which is brought to them in excess. The capillary vessels become therefore expanded, as if filled by artificial injection, and even distinct in those parts where we assume that in the natural state vessels carrying only the uncoloured part of the blood exist: in the subsequent course of the inflammation new vascular branches are formed. The cellular tissue is the most especial seat of the development of vessels. These occurrences are the cause why

(*a*) Library of Medicine.

the inflammation, which at first was to be considered merely as a dynamic disease, brings about distinct changes in the structure of organs. The increased activity of the nerves and capillary-vascular system produces a more copious infiltration into the cellular tissue than in the natural state; a part of the serum—in some cases even of the red part of the blood—penetrates through the expanded walls of the vessels, and empties itself into the cellular tissue. The walls of the cells are, therefore, in this case, found thickened, filled with a serous, albuminous, often bloody fluid, in which frequently albuminous flakes float or are connected with the walls of the cells. The changed condition and increased plasticity of the blood is shown by the *crusta inflammatoria*, which consists of the fibrin of the blood.

According to the different degree of irritation, and the consequent reaction of the nervous system, so long as, excepting the pain, no other appearance of inflammation exists, (which condition many consider as the forerunner of inflammation,) there is produced a spasmodic contraction with accelerated motion of the blood in the small vessels, upon which first follow their vital expansion, the greater influx of blood, and the other phenomena of increased living actions (7). A comparison may therefore be instituted between these local appearances and those coming in with inflammatory fever. As we have there contractions of the vessels and obstruction of the circulation, so we have here chilliness, contraction of the skin, small pulse, which are followed by the phenomena of vital expansion of the vascular system, increased warmth, and so on. In the commencement there is in a manner present an inflammatory spasm—the vascular system is entirely controlled by the nervous system. With the increased influx of the blood, and its accumulation in the capillary vessels, is the previously quickened motion of the blood corpuscles retarded, the capillary vessels, by the consequent exudation of the serum, become completely filled with blood-corpuscles, and an actual stagnation, an inflammatory stasis ensues, but which is not to be considered as a passive over-filling.

[(1) But what causes this increased action of the nerves? The squeezing and stretching of the minute nerves of the part, by the increased size of the capillary vessels, resulting from the obstruction of the current of blood through them, which occurs at the very onset, and which, indeed, is, as will be presently shown, the first step of the inflammatory process. Travers (*a*) considers "the pain of inflammation directly or indirectly connected with the state of the blood-vessels," and it is, "probably, the nerves of the blood-vessels that are first excited in the pain of inflammation." (pp. 46, 7.) This opinion is corroborated by referring to John Hunter's observations on the passage of the adhesive to the suppurative inflammation, in which he says, "The pain is increased at the time of the dilating of the arteries, which gives the sensation called throbbing, in which every one can count his own pulse, from paying attention merely to the inflamed part; and perhaps this last symptom is one of the best characteristics of this species of inflammation." (p. 378.) And in a previous passage he had observed:—"Whether this pain arises from the distension of the artery by the force of the heart, or whether it arises from the action of distension from the force of the artery itself, is not easily determined." (p. 287.) The throbbing, however, is not entirely confined to suppurative, but also accompanies acute, inflammation; and Travers has well observed:—"Throbbing, lancinating or pulsatile pain,—*i. e.* pain accompanied with a sense of motion of the fluids in the part,—is the most characteristic distinction of acute inflammation; and an obtuse, aching, or heavy pain belongs to a congested state of the local circulation." And he also points out that "the description of pain unattended with inflammation, differs from the pain of inflammation, although the former is subject also to varieties in kind, duration and intensity;" observing that "Neuralgia is generally attended more or less with muscular cramp or spasm, and such pain is either intermitting or periodical;" and that such medicaments "as relieve pain in the absence of inflammation have little or no beneficial effect on the pain of inflammation. Blood-letting aggravates neuralgia and relieves inflammatory pain. Steel and arsenic aggravate inflammatory pain, and cure neuralgia." (pp. 45, 6.)

(2) According to his neuropathological theory, Henle (*b*) asserts, that "it is through the nervous system that the exciting cause of inflammation operates, by suspending the

(*a*) Physiology of Inflammation.

(*b*) I have made use of the Digest of this Author's Pathologische Untersuchungen, 1840, and of his Bericht über die Arbeiten im Gebiet der rationellen Pathologie seit Anfang des Jahres, 1839; in Wharton Jones's excellent Report on the Theory of Inflammation, in Forbes's Brit. and For. Med. Review, vol. xvii., 1844.—(J. F. S.)

nervous influence from the small vessels, and consequently determining relaxation of their walls with dilatation of their calibre." (p. 578.) The mode of action of the exciting cause he describes as follows:—"The exciting cause, of what nature soever it may be, whether external or internal, acts primarily on sensitive nerves, exalting their activity. The motor nerves of the vessels which have sympathetical relations with the excited sensitive nerves, are secondarily affected. But this affection of the motor nerves of the vessels, which supervenes by reflex action on the excitement of the sensitive nerves, is not a corresponding state of excitement, but an opposite one of depression, of suspension of action, of paralysis. This form of sympathy, on which the state of excitement of one nerve determines depression of another, HENLE calls *antagonism;* when to that in which a state of activity of one nerve is called forth by a corresponding state of another, he applies the term *sympathy* in a more restricted sense than generally employed: the latter form is more common in the domain of the cerebrospinal system; the former in that of the ganglionic system, the source of the nerves of the vessels. Sometimes, however, sympathy is exemplified in the vessels by constriction supervening on irritation and preceding dilatation; but, in most cases, relaxation and dilatation of the vessels from suspension of nervous influence, are the primary effect of the irritation, no matter whether that irritation have been violent or moderate. Hence HENLE contends that the relaxation of the vessels, on which their dilatation depends, cannot be a mere consequence of exhaustion of the vessels from previous action, as suggested by ALISON and BILLING, but can only be antagonistic." (p. 582.)

As to the cause of inflammation, HUNTER observes:—"I will venture to say, that any cause which can obstruct the motion of the blood for a given time, will become the cause of inflammation; for, either the cause of the obstruction itself, or the blood being retained in the smaller vessels for a certain time, will either irritate or unite the parts, or, where it irritates, will throw the vessels into such actions as naturally arise out of an extraneous irritating cause, but not an increased motion of the blood behind, to drive on the obstructed blood through these vessels, as has been supposed." (p. 259.) The truth of these views is fully borne out by the observations of more recent inquiries, some of which will be presently detailed.

(3) In reference to the pain in inflammation, HUNTER also notices that, as "Many parts of the body in a natural state give peculiar sensations when impressed: so when they are injured they give likewise pain peculiar to themselves;" of which the pain caused by squeezing or inflammation of the testicle is a good example. "And I may also observe," he says, "that the same mode of impression shall give a peculiar sensation to one part, while it shall give pain to another: thus, what will produce sickness in the stomach, will produce pain in the colon." (pp. 288, 9.)

TRAVERS makes a remark shewing that pain is not necessarily an attendant on inflammation, which is well worth remembrance, and with which few careful observers will not accord. "We are told," says he, "there can be no inflammation where there is no pain. I reply, that there are many, and destructive too; a joint, an eye, nay, the lungs may be destroyed by inflammation without pain; he is a speculative, not a practical, pathologist who does not know this. It would be easy to superinduce pain in either of these cases; but let there be no interference, and the work of destruction in numberless cases is as silent as it is sure." (p. 29.)

(4) Touching the redness, HUNTER observes:—"It is of various hues, according to the nature of the inflammation: if healthy, it is a pale red; if less healthy, the colour will be darker, more of a purple, and so on, till it shall be a bluish purple; * * * it is gradually lost in the surrounding part if the inflammation is of the healthy kind; but, in many others it has a determined edge, as in the true erysipelatous, and in some specific diseases, as in the small-pox." * * * "This increase of red appears to arise from two causes: the first is a dilatation of the vessels, whereby a greater quantity of blood is allowed to pass into those vessels which only admitted serum or lymph before; the second is owing probably to new vessels being set up in the extravasated uniting coagluating lymph." (pp. 283, 4.)

TRAVERS thinks that the intensity of the redness depends "on the degree of fulness (of the vessels) compatible with motion; for, although the oxygen of the atmosphere will redden the blood in the congested vessels of the surface, while circulation, however imperfect, continues, from the commencement of the state of absolute stagnation, the colour gradually undergoes a change from pink to purple. In some modes of inflammation this shade of colour prevails even from the beginning, and soon turns to livid. * * * These varieties are due to the state of the general circulation, which gives its character to the inflammation, and an attending change in the constitution of the blood." (p. 50.)

(5) JOHN HUNTER observes on this point:—"From all the observations and experiments I have made, I do not find that a local inflammation can increase the local heat above the natural heat of the animal." The experiments he made were, 1. in the inflamed cavities of hydroceles, in which the thermometer stood at 98¾° F., an increase ended of 6¾° on the natural heat ascertained prior to the inflammation; but, as HUNTER states, "not equal to that of the blood probably at the source of circulation in the same man:" 2. in a wound of a dog's chest, in which before and after inflammation the heat was 101°: 3. in a wound in the gluteal muscles of an ass 100° before, and varying from 99° to 101½° after inflammation: 4. in the vagina of an ass from 99½°, as before the inflammation to 100½°. In other experiments on mucous surfaces the heat was sometimes the same as before the inflammation, and sometimes increased 1° or 2°." (p. 293 to 300.) "But," as says TRAVERS, "the nerves measure the sensation rather than the degree of heat, and this is a widely different scale from those of Fahrenheit or Réaumur, * * * this determination of blood to the capillaries in blushing is accompanied with a distinct though transient sensation of burning heat to the individual, yet not such as could be ascertained by the most delicate thermometer. It is most probably to be referred to the extraordinary inlet of arterial blood into the capillaries: its longer detention by the congestion proper to inflammation, and the consequent increase and vigour of the neighbouring circulation would give permanency to the sensation, and render the actual increase of temperature appreciable." (pp. 48, 9.)

(6) In reference to the enlargement of the vessels of an inflamed part, and its visibly-increased vascularity, HUNTER observes, that, "instead of an *increased attraction*, there was rather what would appear an *increased relaxation*, of their muscular powers, being, as we might suppose, left to the elasticity entirely. This would be reducing them to a state of paralysis simply: but the power of muscular contraction would seem to give way to inflammation; for they certainly dilate more in inflammation than the elastic power would allow: and it must also be supposed that the elastic power of the artery must be dilated in the same proportion." And he comes to the conclusion, "When we consider the whole of this as a necessary operation of nature, we must suppose it something more than, *simply, a common relaxation:* we must suppose it an action in the parts *to produce increase of size*, to answer particular purposes; and this I should call the *action of dilatation*." (p. 282.)

(7) This is pretty nearly the opinion of Dr. CULLEN, who taught that spasm of the extreme arteries supporting an increased action in the course of them, may be considered as the proximate cause of inflammation, at least in all cases not arising from direct stimuli applied; and, even in this case, the stimuli may be supposed to produce a spasm of the extreme vessels.

The following is a brief account of Dr. JOHN THOMSON'S (*a*) observations on the variation of the current of the blood through the capillaries, resulting from the application of different substances:—"Weak and strong spirits of wine were applied to the smallest arteries of the web in eight or nine different frogs, but without being able to perceive any sensible change in the diameters of the arteries to which the spirits were immediately applied, though the general circulation through the web seemed to be increased by each application of the spirits. The results were the same when the tincture of opium was employed." Weak volatile alkali, or ammonia, produced "a complete contraction in the arteries to which it was more immediately applied. In upwards of one hundred experiments the contraction produced took place in *less than two* minutes after the application of the ammonia. In thirteen experiments contraction did not take place till after a period of *three* minutes. In three or four instances only, in which the ammonia was applied, were the contractions not induced." (p. 83.) "In some instances I thought I could perceive an *increase* of the velocity of the general circulation immediately after the application of the ammonia; in others, this increase, if it took place, *was so small as to be imperceptible:* but the first and most remarkable visible effect of the contraction of the artery from the application of ammonia was a *diminution of the velocity* of the circulation in the capillary vessels with which the contracting artery communicates. When the contraction is complete, a *temporary* stagnation in the capillaries with which the contracted artery immediately communicates is *often* produced. * * * In all these experiments, in which ammonia alone was applied, a paleness rather than redness of the web in the foot of the frog was produced; but this paleness was only of short duration." (p. 84.) "In applying a saturated solution of common salt to the arteries in the web of the frog's foot, I was not a little surprised to observe that these arteries, instead of being contracted as they had uniformly been by the application of the ammonia, were actually and sensibly

(*a*) Lectures on Inflammation.

dilated. The part of the web to which the salt was applied became of a red colour, and this redness, which was visible to the naked eye, lasted in general from a period of three to five or more minutes. It was impossible to view the part with the naked eye, without conceiving it *to be inflamed.*" THOMSON hoped, from "the facility of producing, by the application of salt, a state so accurately resembling inflammation that, by examining the phenomena of the circulation in this state, he should be able to arrive at some satisfactory conclusions with respect to the comparative velocity of the blood in healthy and in inflamed vessels; but he did not upon trial find this so very easy as he had at first imagined. (p. 85.) "The principal difficulty in ascertaining the comparative velocity of the blood in the sound and in the red or apparently inflamed parts arose from the very *variable* results which the application of salt produced in different animals, and in the same animal, in different circumstances." Thus, in nine cases, "the application of the salt was not only followed by a bright red colour visible to the naked eye, and a sensible enlargement of the arterial and venous branches, but with an increased rapidity of circulation also in the capillary vessels. * * * The repeated application, however, of the salt to the same vessels was *always sooner or later* followed by *retarded* capillary circulation, or even by *complete stagnation.* A second general result from the application of the salt was an apparent increase of circulation in the arteries and veins, with a diminution of velocity in the capillary branches. * * * In no one experiment have I been able to perceive any enlargement of an artery during the momentary influx of blood into its canal. The third and *most frequent* result from the application of salt was *diminished* rapidity of circulation in arteries, veins, and capillaries. In seventeen experiments the circulation became *so slow* as to stop altogether in the capillaries, and this stagnation, which usually goes off in a few minutes, continued in some instances for several hours. The enlargement of diameter in arteries, veins, and capillaries is very conspicuous: they may be said to be distended. * * * In every experiment with salt, whether the velocity of the circulation was increased, diminished, or stopped, the diameters of the blood vessels were *uniformly enlarged,* and this increase of diameter continued till the redness spontaneously disappeared." (pp. 86, 7.) From these observations THOMSON comes to the conclusion, that, "If this view of the state of the circulation in inflamed vessels be just, it will follow that inflammation is sometimes attended by an increased, and at others by a diminished velocity in the circulation through the capillary vessels of the inflamed part, and, consequently, that neither of those two states ought to be included in the definition which we give of inflammation." (p. 88.) These experiments and conclusion of Dr. THOMSON are mentioned, because they are the first by which the condition of the vessels and the state of the circulation under inflammation have been attempted to be explained: but they are inconclusive; for, as observed by J. W. EARLE (*a*), "although that state of parts which was induced by the application of salt, viz. retardation and stagnation of the blood, presented the strongest resemblance to inflammation, yet in no one instance did either state continue for a sufficient length of time to allow any one of the usual accompaniments of inflammation (to wit, the effusion of lymph or pus, or mortification) to be produced, since each variation terminated more or less speedily in the restoration of the natural current." (p. 40.)

Dr. W. PHILIP (*b*) applied "to the web of a frog's foot, placed under a microscope, distilled spirits, and in a few seconds observed the blood in all the vessels moved with a greatly *increased* velocity, which, as he constantly kept the web wet with the distilled spirits, continued as long as he observed it, ten minutes or a quarter of an hour; but during no part of the time could he perceive the *slightest symptom* of inflammation, either with or without the microscope. The vessels, instead of appearing redder and more turgid, were evidently paler and smaller than before the application of the spirits." (p. 30.) Hence it appears that his experiment does not in its result tally with THOMSON's, who at first did not observe any increased velocity, nor ever any sensible change in the diameter of the arteries. It is probable that in neither case did the spirit operate beyond constricting the parts by the cold its evaporation produced. In another experiment, however, inflammation was produced in the web of a frog's foot, and then Dr. W. PHILIP (*c*) "found the vessels of the part greatly dilated and the motion of the blood extremely languid. In several places where the inflammation was greatest, the vessels were most distended and the motions of the blood were slowest." (p. 15.) He therefore considered that in inflammation the blood vessels were in a state of debility.

(*a*) On the Nature of Inflammation, &c.

(*b*) An Experimental Inquiry into the Laws of the Vital Functions. London, 1826. 8vo.

(*c*) Introduction to a Treatise on Symptomatic Fevers, including Inflammations, &c. 4th Edit. London, 1820.

The account given by GENDRIN (*a*) of the steps by which the stagnation of the blood in inflammation is produced is very interesting:—"The capillaries around this (irritated) point dilate, and seem to multiply themselves; because a greater number is perceived on account of the presence of red blood, which, in colouring them, renders them more visible. The globules arrive; they are crowded together, their motion is retarded, and at length suspended; they *revolve upon themselves*, and at last remain entirely at rest. The capillary circulation is then evidently suspended in the point irritated; for some distance around, the retardation of the circulation and dilatation of the capillaries are plainly seen; a little farther off the circulation is more rapid, the capillaries being still dilated, and the globules of the blood less distinct; finally, at the limits of the inflamed areola the circulation is, on the contrary, accelerated, the capillaries dilated, and the blood contains a greater number of globules. All these changes may take place in four or five minutes, and the same space of time is sufficient to allow of the capillary circulation returning to its natural state." (vol. ii. p. 475.) The objection made by EARLE to THOMSON'S experiment, that inflammation had not been excited, might perhaps, strictly speaking, be made use of here; but it is quite clear that the experiment had reached the turning point from healthy to diseased action.

THOMSON'S experiments have been repeated and detailed by TRAVERS, in his chapter, *Direct Effects of Stimuli and of Wound*, and all coincide in producing the same phenomena, excepting that with ammonia; in which TRAVERS'S observations are remarkably opposed to those of THOMSON; for "the application of ammonia," says he, "produced an *instant increase of velocity*, then stagnation, with the deepened tint of colour and enlargement of vessels." (p. 36).

TRAVERS gives a very beautiful account of "the oscillation attending the recovery of the circulation, which seems to be the *punctum saliens*, or first movement towards the formation of the new circulation." (p. 166.) * * * "The first effect of a drop of stimulant fluid, or of a wound upon a transparent web, (frog's foot,) as seen in the field of a powerful microscope, is," says he, "to arrest the circulation at the part. Around the point of absolute stagnation, the column of blood oscillates, and the particles are seen to separate and congregate in small irregular masses, presenting varieties of shape, some being perfect ellipses, others spherical. The vessels are dilated, and, in proportion, their fulness is increased, and their pink colour heightened. Still more remote from the stagnant centre increased activity of circulation prevails. The point of stagnation, the very slow circulation in the part immediately surrounding it, the current still oscillating in parts, and beyond this the more rapid and vigorous circulation, are manifested for several days. The contrasted appearance of one portion of the web stationary, and another in brisk circulation, is striking. The labour also of the current, the sudden overcoming of the obstacle occasioned by a too crowded passage, and the instant velocity succeeding thereupon, reminds us of the swaying backward and forward, and at length the inrush, of a crowd emerging into an open space from a narrow avenue." (p. 34, 35.)

BENNETT says:—"It is very difficult to determine the cause of oscillation in the column of blood. It may be remarked, however, that this phenomenon has only been observed in the smaller animals which are held fast under the microscope. Even here the oscillation is not invariably seen to precede the stoppage. It is most frequently observed, also, when the animal is very weak, or has fallen into asphyxia. Under such circumstances the energy of the heart and large vessels is evidently diminished, and the blood will be propelled with less force than usual against the capillaries, and either stop for a moment, or flow backwards during the diastole of the heart. It is probable, therefore, that the oscillation does not essentially belong to inflammation, but rather depends upon the general weakness of the animal." (p. 33.)

The phenomena attending the first steps of the inflammatory process excited in the web of a frog's foot, as seen under the microscope, are well described by WHARTON JONES (*b*). "Very soon after the irritation," he says, "accumulation and stagnation of the blood in the capillaries, including the terminations of the arteries and radicles of the veins of the part, is observed to take place; but, amidst the obstructed vessels a few here and there may still be seen pervious, and through them the stream of blood is very rapid. The accumulation and stagnation of the blood in the small vessels is always preceded by a retardation of its flow (coincident with dilatation of the vessels;) this retardation of the flow of blood having or not been preceded by the opposite condition of an accelerated flow (coincident with constriction of the vessels.)" He then proceeds to inquire into "the behaviour of the blood during the retardation of its flow and at

(*a*) Hist. Anat. des Inflammations. (*b*) Report.

the time of its stagnation," which he thus describes:—"a. *Colourless corpuscles.* During the retarded flow of blood immediately preceding stagnation, an accumulation of colourless corpuscles is observed to take place on the inner surface of the walls of the dilated small vessels, similar to what occurs in the healthy state when the velocity of the stream of blood is diminished. b. *Red corpuscles.* While the accumulated colourless corpuscles may have even become stagnant on the walls of the vessels, the red corpuscles, though in increased quantity, in proportion to the plasma, still continued to float on, but more and more slowly until complete stagnation ensues. They are somewhat more collapsed than natural; hence they appear redder, and their nucleus is less indistinctly seen, a change similar to what takes place in the red corpuscles of newly drawn blood. The red corpuscles appeared to be the agents principally concerned in the stagnation of the blood * * * by agglomerating together, and applying themselves here and there flat against the walls of the vessels and adhering to them; whilst other red corpuscles applied themselves to those already adherent." (p. 568, 9.) This view had been already put forward by JONES in 1842; and about the same time was described more at length by EMMERT and by VOGEL. The following is the brief account which JONES gives of their statement. According to EMMERT, the colour of the red globules becomes somewhat deeper, and hence individually they appear less transparent; their surface is less smooth, and the irregularity of their edges is peculiarly distinct: they acquire the property of remaining adherent to each other and to the walls of the vessels when they come in contact with them. When the flow of blood becomes retarded and oscillations commence, the blood-corpuscles apply themselves, according to VOGEL, more to each other; and, though still individually distinguishable, they still touch, and in the smaller capillaries are often pressed close together by their surfaces in the manner of rolls of coin. The space next the walls seems merely filled with plasma; but, in complete stagnation of the blood, it disappears, and the interior of the vessel is completely filled with blood-corpuscles closely aggregated, and forming an apparently homogeneous indistinctly granular mass, in which individual blood corpuscles can scarcely be distinguished: but this fusion is merely apparent; for, if the blood be evacuated by opening the vessels, the individual corpuscles again appear quite distinct." (p. 568.)—J. F. S.]

5. Every injury which acts as an irritant upon any one organic part, may be considered as an incidental cause of inflammation. The necessary intensity of this irritation cannot, in general, be determined; it depends upon the individual susceptibility and condition of the organs. Powerful, young, full-blooded, sanguine, or choleric subjects, are most prone to inflammation; the disposition to which is strongest when the fibrin of the blood is increased in quantity. Inflammation arises most readily in parts which are very sensitive, and in which the capillary-vascular system is much developed. The usual incidental causes of inflammation are, a peculiar condition of our juices differing from the natural commixture, suppression of ordinary discharges, contagious matter, mechanical influences, falls, blows, wounds, and so on, cooling after preceding heat, burning by fire, corroding substances, and so on.

[To these we may also add, with JOHN HUNTER, "that fever is often the cause of local inflammation. We see this happen every day. * * * These inflammations, in consequence of fever, are commonly supposed to be critical; but I very much doubt the truth of this opinion." (p. 257.)

"Irritating substances," says JOHN HUNTER, "when of no specific kind, produce inflammation sooner than other visible causes of inflammation. If of a specific kind, then the time, sort, and violence will be according to that kind. But irritating applications must be continued for some time to produce violent inflammation. These differences are easily accounted for: quick death does not irritate the part killed, and the contiguous living part, not being itself hurt, is only irritated to get rid of the dead part. A wound is a quick irritation of a living part, so that it inflames more readily and more violently, according to the quantity of irritation; but that cannot be of long standing, as nature sets about procuring relief. But when irritating substances are applied, the part inflames quickly, according to their power of irritation; and, if they are continued, nature is not allowed to relieve herself, but is constantly teased, by which means the inflammation becomes also violent." (p. 257.) "All inflammations attended with

disease have some specific quality which simple inflammation has not; and in such cases it is the specific quality which is the disease, and not the inflammation." (p. 260.) "There are many constitutions which have a tendency to specific diseases, that, when injured by fever or any constitutional complaint, readily produce the specific inflammation in such parts of the body as have the greatest susceptibility for any specific action; or, if such parts are affected by any local violence, the parts affected will not go through the healthy adhesive inflammation, nor will they enter into the healthy suppurative inflammation, but will fall into the specific inflammation peculiar to the habit: such is the case with an erysipelatous habit. Or, if a specific inflammation has already taken place, any violence done to it, when already begun, will increase that disposition and action, which we plainly see to be the case with the scrofula, because this disease can, and often does, arise from such a cause alone." (p. 261.)]

6. The *results* of inflammation are *resolution*, *exudation*, *suppuration*, *ulceration*, *induration*, *and various other transformations of organs*, *softening*, and *mortification*. All these conditions, excepting resolution, are merely different living processes, which are brought about by inflammation, and are still accompanied by it for a long time.

7. In Resolution (*Resolutio*, Lat.; *Zertheilung*, Germ.; *Résolution*, Fr.) the appearances of inflammation subside nearly in the same order as in their development they set in with, and the diseased part reverts to its natural condition. The pain diminishes, or disappears first; in the same degree the temperature and the redness lessen, the swelling alone often remains for a still longer time, till the absorption of the serous or albuminous fluid poured into the cellular tissue is completed.

We may hope for this result when the inflammation has not quickly run on to a great extent, the pain neither particularly severe nor throbbing; and when the fever accompanying the inflammation terminates critically in perspiration and deposit in the urine.

Resolution is distinguished from the *disappearance* or *recession* (*Verschwinden* oder *Zurücktreten*, Germ.; *Délitescence*, Fr.) of inflammation, which is in general connected with its simultaneous or speedy development in another organ. This recession depends on the succession of an irritation which is more severe than that which kept up the earlier inflammation. It is often merely a state *of changed vital activity*, of increased sensibility, which produces the removal of the inflammation, particularly if it be treated with repelling astringent remedies. Certain inflammations, as erysipelas, and critical inflammations, have a peculiar disposition to recede.

[The process of resolution has been well described by Dr. J. H. Bennett, as follows:—"Resolution or absorption of the exudation may occur in various ways, and follow any of the transformations of the exudation except the one which converts it into permanent tissue. The early phenomena first disappear; the capillaries recover their contractility; the attraction between the blood and the parenchyma ceases; and the blood within the vessels begins to oscillate, and at length flows in a continuous stream. Secondly, the essential phenomenon disappears, no further exudation takes place, and that already poured out is absorbed. It occasionally, though rarely, happens, that the exudation does not coagulate for some time after it is exuded. Under these circumstances, when the early phenomena terminate, it re-enters the vessels by endosmosis, unchanged. In the majority of cases, however, it coagulates, and, once rendered solid, it could never be absorbed without the occurrence of changes in it by which it is again rendered fluid. This is effected by the formation, ripening and disintegration or decay (moulting process of Schulz) of nucleated cells, whereby the coagulated exudation is broken up, made soft, pultaceous, and diffluent, and at length absorbed. By this process exudation poured out into the lung or brain gradually disappears, by the production of inflammatory softening. On the serous surfaces the fluid and broken down corpuscles are absorbed; but that portion which passes into permanent organization, is transformed into fibrous tissue, becomes covered with a smooth membrane, so that the functions of the organ are not disturbed. Abscesses when resolved undergo a similar process. The pus-cells, instead of being evacuated, are brought closely together from the absorption of the more fluid portion (*liquor puris.*) These are gradually broken down, the cell-walls are dissolved, and the whole is

reduced to a molecular matter, which re-enters the vessels, and thus complete resolution is produced. The disintegration of pus-corpuscles previous to absorption is evidently favoured by the pressure which the abscess receives from the contraction of the filamentous and elastic tissues that form its walls. * * * It is probable also, by increasing the contraction of the integuments, as well as by removing fluid from the neighbourhood of the part, that irritants, blisters and cauteries, are so beneficial in the resolution of abscesses. It is suggested by ZIMMERMAN, that the formation of an acid, as the lactic, in abscesses when fully formed, favours their disintegration. We have seen that acetic acid dissolves the cell-walls and causes the nucleus to appear in the form of granules: if lactic acid be produced, it would probably have the same effect. Alkaline solutions also, it is well known, dissolve pus-corpuscles, a circumstance that may explain the discutient effects of alkaline lotions and washes, and their beneficial operation in removing the incrustations from eruptive pustular diseases." (p. 63–5.)

As to the question "What becomes of the molecular fibrin which thus re-enters the circulation?" BENNETT states that "the observations of several German physicians, more especially of SCHÖNLEIN and ZIMMERMAN, have thrown much light upon it, and determined that the changes which the urine undergoes in acute inflammatory diseases, bear a relation to the absorption of exuded blood-plasma in internal organs. Thus, in a case of pneumonia, SCHÖNLEIN pointed out that the disappearance of dulness was accompanied by a turbid state of the urine, which contained a large amount of molecular fibrin, and was also highly coagulable by heat. ZIMMERMAN has recorded instances where the turbidity and coagulability of the urine bore a marked relation to the diminution of suppurative swellings. In some cases where purulent matter was apparently absorbed, he had observed that the urine was coagulable from the presence of fibrin dissolved in it" (*a*). Hence it is concluded "that the molecules of the broken-up exudation, after circulating in the blood, are frequently eliminated by the kidneys, and make their exit from the system by the urine, sometimes entire, at others in a state of solution. * * * Occasionally the excess of fibrin may be eliminated by the skin, lungs, and bowels. In all cases it constitutes an important symptom of the crisis." (p. 65.)]

8. Exudation (*Exsudatio*, Lat.; *Ergiessung*, Germ.; *Exsudation*, Fr.) is the outpouring of a larger quantity of serous fluid than the capillary vessels ordinarily exhale into the cellular tissue, into the parenchyma of organs, or into the cavities of the body. For the most part it occurs towards the end of the inflammation, or at least when it is subsiding. The fluid poured out (serum and coagulable lymph) differs in respect to its composition; often thin and transparent, often consistent, mingled with flocculi, and so on. The thicker part of this exudation (the coagulated albumen) not unfrequently unites neighbouring parts, vessels are prolonged into this interstitial substance, and *adhesion* is effected. If the fluid poured into the cellular tissue be only serous, then *dropsical swelling* (*œdema*) is produced. The exudation occurs, especially often in serous membranes: not unfrequently also does a similar exudation accompany inflammation of the mucous membranes. These exudations may be accompanied by an inflammatory or weakly condition of the capillary vessel.

[The term "exudation," as here explained by our author, is synonymous with "effusion," as generally employed by British practitioners; but the latter, by defining the nature of the matter poured out as effusion of serum, of coagulable lymph, &c., make a distinction which the former does not. Neither of these terms, however, thus used, seem sufficiently pointed; but their employment as proposed by J. HUGHES BENNETT is unobjectionable. "*Effusions*," he says, "no doubt are very common; but, in the great majority of instances, they arise from venous obstruction, altogether independent of inflammatory phenomena. * * * In all such cases the fluid is clear, holds no fibrin in solution, and on being evacuated shows no disposition to coagulate. * * * In inflammatory effusions, on the other hand, the fluid is more or less turbid, containing fibrin in solution, and, if allowed to stand, flocculi swim in it, or sink to the bottom of the vessel. * * * Mere effusion, then, cannot itself be considered as characteristic of inflammation. It may be the result of congestions non-inflammatory, or, if otherwise,

(*a*) Ueber den gerinnbaren Harn; in CASPER'S Wochenschrift, 1843, p. 345.

passes more or less into exudation. In every instance of undoubted inflammatory action an *exudation* of blood-plasma occurs which may be made visible. * * * Where the *liquor sanguinis* is poured out into shut cavities, the same phenomena occur as when blood is drawn from the body. The fibrin coagulates, and the serum is set free. The former then lines the serous membrane, and is denominated coagulable lymph, whilst the latter is called serous effusion. * * * In parenchymatous tissues, however, as in the lungs, liver, brain, &c., the structure of the parts will not allow of this distinct separation. The *liquor sanguinis* exuded is, of course, at first fluid, and, in this state, insinuates itself among the elementary structure of the organs, filling up every minute space. When it coagulates, the tissues of the part affected are completely blocked up, as if with cement. The blood-vessels, nerves, filaments, &c., are surrounded by a solid mass, in the same manner that the stones in a wall are surrounded by mortar." (pp. 38, 40.)

As to he effusion of serum, TRAVERS observes:—"The first change external to the vessels in inflammation is not a permanent change, and looks like a measure of temporary relief to the over-loaded vessels which surround the inflamed centre. It is an aqueous exudation from the colourless capillaries into the adjoining cellular texture. It would seem to be a passive mechanical effect, as it doubtless often is, but for the precedence of other unequivocal signs of inflammation." (p. 65.)

WHARTON JONES says:—"Immediately after or during the stagnation of the blood, exudation commences. From being at first serous the exuded fluid comes at last to be pure plasma, at least a fluid containing a greater or less quantity of fibrin." He attributes the exudation "to the thinning of the walls of the vessels, from their relaxation and dilatation on the one hand and the pressure from within the vessels on the other:" and he also suggests, as likely to promote exudation, "that the plasma will be pressed out from among the aggregating corpuscles, even when the blood would not, if out of the body, present the buffy coat, and that because within the body the fibrin of the plasma does not so readily coagulate;" but, when the blood is so changed that on abstraction the buffy coat appears, "the plasma at the same time that it is more quickly and energetically squeezed out from among the aggregating red corpuscles, will present itself in greater quantity and richer in fibrin, for transudation through the walls of the capillaries." He considers, with WATSON, that the cause of serum alone passing out first, "is, as in common œdema, owing to obstruction; the obstruction in inflammation being from the stagnation of the blood;" but how obstruction determines exudation of serum alone, remains a question: to help to a solution of this, it may be stated that, according to KÜRSCHNER, water passes most quickly through animal membranes and saline solutions more quickly than viscid, gummy, and albuminous solutions. With exudation," he says, "is completed the inflammatory process properly so called." (pp. 584, 5.)

"The extravasation of the serum along with the coagulating lymph," says JOHN HUNTER, "is, probably, not a separation of itself, as in a dropsy; but, a part of it being separated from the lymph in the coagulation of that fluid, is squeezed into the surrounding cellular membrane, where there is but little extravasation, and where the cells are not united by it. Thus, the circumference of such swellings is a little œdematous; but the whole of the serum if there be a depending part will move thither, and distend it considerably, as in the foot in consequence of an inflammation in the leg. But, in most cases, there is a continued extravasation of serum long after the extravasation of the coagulating lymph is at an end, so that depending parts will continue œdematous, while the inflammation is resolving, or while suppuration, or even healing, is going on. The whole swelling looks like a part of the body only a little changed, without any appearance of containing extraneous matter; and indeed it is simply formed by an extravasation of fluids without their having undergone any visible or material change, except coagulation." (p. 285.)

GERBER speaks of the exudations after inflammation as *watery* or *serous* exudation when merely the serum of the blood is poured out; *plastic*, when the *liquor sanguinis* containing fibrin exudes without the blood-corpuscles; and *sanguineous*, when it is blood-coloured; the colour depending either on solution of the colouring matter of the blood, or the effused *liquor sanguinis* contains all the components of the blood and even the blood-globules, thus forming the transition to hæmorrhage (p. 42.) He says, also, that in the fluid of *serous exudations* albuminous granules of albuminous fluids are usually found; that after *plastic exudations* a yellowish turbid fluid is found in it, or precipitated upon and perhaps adhering to the walls of the exuding surface. If the exudation of plastic matter go on longer, and the quantity of effused *liquor sanguinis*, be considerable,

the cavities may be filled with it; their walls and the organs they include may be covered with thick layers of fibrin, which at first is of a pale yellow hue and somewhat transparent, with the consistency of imperfectly coagulated albumen. If death then occur, this hyaline substance quickly becomes granular, and, in consequence of chemical decomposition, is dissolved in the serum; but, if life continue, the characters of the exudation are otherwise altered (p. 42;) which alteration he proceeds to describe as follows:—"The separated serum is gradually absorbed whilst the fibrin floating in it is dissolved. The fibrin which is attached, on the other hand, becomes of a chrome-yellow colour, and, if examined under the microscope, is found to consist of a connected exudation of corpuscles, which are found in form twenty-four to thirty hours after the exudation, when the mass is of an orange yellow, and has acquired such consistence as to be stripped off the membrane in slips. * * * The exudation-corpuscles are in every respect the same as the lymph-corpuscles; they generally form many superimposed layers, being laid flat one over another, and so constituting membranes which completely resemble the tessellated epithelium when the connecting medium has disappeared, so that the edges of the primarily round corpuscles thrust against each other, and are thus rendered polygonal." Subsequently the cohesion increases, and a more fibrous structure is indicated, and "under the microscope an ever-increasing linear arrangement of the exudation-corpuscles, which are more intimately united at two opposite points in one line, by means of the connecting cyto-blastema than any where else, is apparent. The original globular cyto-blasts now assume a spindle-like form, and the flat ones continue more flatted as their margins have become more spindle-shaped, and in their linear connexion form varicose fibres, at the enlargements of which the nucleus of the exudation-corpuscle continues visible, and either subdivides into several granules, or a new nucleolus is formed within it. Between these now formed cellular fibres there still remains an inter-cellular hyaline substance, so that the masses may be separated mechanically in any direction." (p. 434.)

Valentin (*a*) describes the exudation-corpuscles as "like so many embryonic nuclei—round, granular, and lying tessellated one upon another, whilst their very small interstices contain a transparent gelatin." (p. 215.)

Gulliver (*b*) differs from Gerber as to the similarity between the exudation and lymph-corpuscles. "In mammiferous animals," he says, "it has always appeared to me that the lymph-globules differ in size, structure, and chemical characters from exudation-globules. The latter are larger, more irregular in size and shape, more spongy or loose in texture than the former;" generally exhibit two or three nuclei when treated with acetic acid, whilst the lymph-globules are only rendered slightly smaller by it. The acid either dissolves or makes remarkably fainter the comparatively thick shell of the exudation-corpuscle, while the lymph-globule becomes more distinct when subjected to the action of the acid." * * * "The lymph-globules, in fine, in progress of development, may soon become more or less coated with fibrin; but, if examined at an early period, they will be found to resemble in chemical characters the nuclei (nucleoli of Valentin) of primary cells." (p. 83.)]

9. Suppuration (*Suppuratio*, Lat.; *Eiterung*, Germ.; *Suppuration*, Fr.) is, when resolution does not ensue, the suitable termination of simple inflammation, and, if that be severe, it appears the natural result; therefore, a *fully developed simple inflammation* is termed, by some, *suppurative inflammation*. The pus is secreted through the walls of the capillary vessels, not, however, immediately as such, but is first formed by the changes which the inflammatory exudation undergoes; the coagulated fibrin is gradually converted into pus-globules, which then mix with the serum. Pus is formed of all the components of the blood, the colouring matter excepted, and especially from its albumen and fibrin. If it collect in the cellular tissue, *Abscess* (*Eitergeschwülste*, Germ.; *Abcès*, Fr.) is produced. The process of suppuration is a true secretion, and the vital condition of the organs influences it as well as all other secretions. There is usually no destruction of tissues connected with suppuration. That we often find the remnants of destroyed cellular tissue in pus, or that the skin

(*a*) See his "Principal Features in the Development of the Animal Tissues," in Wagner's Elements of Physiology, translated by R. Willis, M.D.
(*b*) His notes in the Translation of Gerber.

covering the abscess is destroyed, depends on accidental circumstances—in the great distension of the cellular tissue and skin, or in the suppuration, from general or local mischief, passing into *Ulceration* (*Verschwärung*, Germ.; *Ulcération*, Fr.) These remnants of destroyed cellular tissue must not be confounded with the *cores* (*Eiterpropfröpfen*, Germ.) so called *sloughs*, which are found in the midst of the inflamed cellular tissue, at the commencement of suppuration, in the form of white jelly-like semi-transparent stringy flocks, which have no trace of organization, are at first firmly connected with the surrounding cellular tissue, but subsequently are thrown out with the pus. These cores are tough concretions of coagulated albumen.

The various opinions relating to the formation of pus may be arranged in two classes:—1. It was supposed that pus was formed and secreted within the vessels of inflamed organs by the peculiar activity of the former. 2. That pus was produced externally to the vessels of the inflamed organs, either in the solid parts in a state of inflammation, or in the effused fluids undergoing a change similar to that of fermentation or putrefaction. According to the former opinion suppuration must be considered as a vital, according to the latter as a chemical, process. The formation of pus as a secretive process first published by SIMPSON (*a*), more fully discussed by DE HAEN (1756,) and by MORGAN (*b*), was specially and more accurately proved by HUNTER, by BRUGMANS (*c*), and by PINEL. Upon the other supposition BOERHAAVE ascribed the formation of pus to the dissolving of the hard parts and the changes which take place in the effused blood; BELL and others to the putrefaction of the serum; GOTTER and QUESNAY, to the change in the coagulable lymph; HOFFMAN and GRASHUIS, to the decay of the fat; and STEWART to putrefaction of the chyle.

The process of the pus formation and the nature of pus, besides the above-mentioned writers, most meritoriously occupied PEARSON (*d*), HEWSON (*e*), E. HOME (*f*), BERZELIUS (*g*), GRUITHUISEN (*h*), and have been recently examined with the greatest care; FISCHER (*i*) has furnished observations on its chemical composition; DONNE (*k*), GLUGE (*l*), and VALENTIN (*m*) have enriched our knowledge of its microscopic elements; GUTERBOCK (*n*), WOOD (*o*), BONNET (*p*), and MANDT (*q*) have, in a chemical and microscopical view, furnished correct observations, which VOGEL (*r*) for the most part arranged and increased with the results of his own observation. Compare also VOGEL (*s*) and E. V. BIBRA (*t*).

10. The transition of inflammation into suppuration is probable—when the inflammation is active and quickly reaches an acute stage; when the pain is severe, the distension and swelling are considerable, the inflamed part of a lax character, and surrounded with much cellular tissue (1). If the inflammation continue longer than usual, without showing critical movements, if the pain becomes throbbing, the redness and swelling diminish without entirely disappearing, the swelling becomes softer, and the patient has a shiver, then the formation of pus has commenced; the swelling becomes still softer, is elevated in the middle, and sunk at its circumference,

(*a*) Disput. de re Medicâ, 1722.
(*b*) Tentamen Medicum de Puris confectione. Edinb. 1756.
(*c*) Diss. de Puogeniâ. Groenig. 1785.
(*d*) Observations and Experiments on Pus, in Phil. Trans. 1810, p. 294.
(*e*) In his Experimental Inquiries, Part the Second, containing a description of the Lymphatic System, &c., p. 117. London, 1774. 8vo.
(*f*) A Dissertation on the Properties of Pus. London. 1788. 4to.
(*g*) Article "Pus," in his Traité de Chimie, traduit par M. ESSLINGER sur des Manuscrits inédits de l'Auteur et sur la dernière édition Allemande, vol. vii. p. 635. Paris, 1833. 8vo.
(*h*) Naturhistorische Untersuchungen über den Unterschied zwischen Eiter und Schleim. München, 1809.
(*i*) De Puris indole ejusque à pituitâ discernendi Methodis. Dorpat. 1836.
(*k*) Archives générales de Médecine. 1837, Août.
(*l*) CASPER'S Wochenschrift. 1843.
(*m*) Repertorium für Anatomie und Physiologie, 1837. Part ii. p. 197.
(*n*) De Pure et Granulatione. Berol., 1837.
(*o*) De Puris naturâ et formatione. Berol., 1837.
(*p*) Mémoire sur la composition et l'absorption du Pus; in Gazette Médicale de Paris, 1837. No. 38.
(*q*) Ueber den Eiter, den Schleim, und die verschiedenen Ergüsse; in SCHMIDT'S Jahrbücher, 1838, No. 19, p. 274.
(*r*) Physiologisch-pathologische Untersuchungen über Eiter, Eiterung, und die damit verwandten Vorgänge. Erlangen, 1808.
(*s*) In WAGNER'S Handwörterbuch der Physiologie, etc.
(*t*) Chemische Untersuchungen über verschiedene Eiterarten und einige andere krankhafte Substanzen. Berlin, 1842.

and on touching it *fluctuation* (*Schwappung*, Germ.) is felt. In order to be assured of this, the fingers may be pressed alternately upon the swelling, or, what is preferable, the finger or the flat hand may be laid on the side of the swelling, while this is gently tapped with the fingers upon the other, by which the undulations of the pus are communicated to the hand. The skin becomes transparent at the most elevated part, and the pus is seen through it; finally, the skin breaks by the process of continued absorption, and the pus is discharged. If the parts covering the abscess are unyielding, an extension of the suppuration takes place in various directions before it makes its way out (2). If the inflammation be slight, it often continues a long time without exhibiting any disposition to break. It is often very difficult to distinguish the transition to suppuration in inflammation of deeply situated or in internal organs. The usual appearances are—the symptoms of inflammation subside without crisis, the part does not return to its natural functions; it feels to the patient heavy, oppressive, or cold; he has frequent shiverings; the appearances of hectic fever set in, burning heat of the hands and soles of the feet, especially after eating, circumscribed redness of the cheeks, emaciation, night-sweats, purgings, and so on. Deep-seated fluctuation is felt, or the surface of the part exhibits an œdematous swelling. The symptoms of hectic fever accompany every considerable suppuration, and it is probable that this must be ascribed partly to the loss of the albumen and fibrin of the blood, and partly to the absorption of pus.

The circumscription of the pus in the cavity of the abscess depends upon the effusion and coagulation of the plastic lymph, which occur during inflammation, whereby a cavity with smooth walls is produced, in which the capillary vessels are very strongly developed, so that the pus is shut off from the other cellular tissue, and its spreading from cell to cell is prevented. In cases in which the inflammation is not connected with plastic exudation this circumscription of the abscess does not take place; for instance, in many erysipelatous inflammations. If suppuration occur on the surface of serous membranes, there must always be first produced a considerable development of vessels. In structures which are very highly vascular, suppuration occurs more rapidly. The walls of the abscess must be considered as *secreting* and *absorbing* surfaces. In the resorption of pus, (by the veins and lymphatic vessels,) it is mixed with the blood and separated from it by the colatories of the body, specially the lungs and kidneys, or is deposited in the tissue of parts (metastatic abscesses;) it is, however, undetermined whether the pus is deposited as such or is produced by the after-changes which commonly occur in the inflammatory exudation (Vogel.) As the pus-corpuscles are larger than those of the blood, they cannot pass through the capillary vessels, and therefore only the serum of the pus is absorbed, or the pus-corpuscles are broken down, and can then also be absorbed. We must not confound with this the entry of pus into a torn vein, or its formation by phlebitis in the vein and its further passage onwards with the blood. In regard to the operation of absorbed pus, Bonnet supposes that the absorption of good, cream-like pus, which has not been changed by the action of the air, will not produce any peculiar symptoms, because with it nothing enters into the blood but what is natural to it; but, if in depraved putrid pus hydrosulphate of ammonia be developed with a residue of ammonia, and be absorbed with the serum or pus, a septic poison is introduced into the blood, the presence of which has been ascertained by Bonnet in the blood, and its separation in the urine.

[(1) "The true inflammatory disposition and action," says Hunter, "almost immediately ceases upon the commencement of suppuration; and, although the vessels may be nearly in the same state, yet they are in a much more quiescent state than before, and have acquired a new mode of action." * * * And he asserts, "as an invariable fact, that no suppuration takes place which is not preceded by inflammation; that is, no pus is formed but in consequence of it." * * * "The immediate state of parts which may be called the immediate cause of suppuration, I conceive to be such as cannot carry on its usual functions of life, and which state of parts I have called the state of imperfection, let the cause of that state be what it will; we have shown that irritation

simply is not always sufficient, it often only brings on the adhesive stage, which is in most cases intended to prevent the suppurative." (p. 372.) "In spontaneous suppurations, one, two, three, or more parts of the inflammation lose the power of resolution, and assume exactly the same disposition with those of an exposed surface, or a surface in contact with an extraneous body. If it is in the cellular membrane that this disposition takes place, or in the investing membranes of circumscribed cavities, their vessels now begin to alter their disposition and mode of action, and continue changing till they gradually form themselves to that state which fits them to form pus; so that the effect or discharge is gradually changing from coagulating lymph to pus: hence we commonly find in abscesses both coagulating lymph and pus, and the earlier they are opened, the greater is the proportion of the former." (p. 378.)

"Should the exudation become purulent, this gelatin (viz. that which is interstitial to the corpuscles) acquires fluidity," says VALENTIN, "and the plus globules then swim in the *liquor puris*, sink tessellated to the bottom, and surround themselves with cells, which subsequently undergo tranformation in accordance with certain laws into exudation fibres or exudation membranes." (pp. 215, 216.)

"This (suppurative) inflammation has symptoms common to inflammation in general; but," says HUNTER, "it has these in a greater degree than the inflammation leading to it, and has also some symptoms peculiar to itself: * * * it gives as much as possible the idea of simple pain without having a relation to any other mode of sensation: * * * the pain is increased at the time of the dilating of the arteries, which gives the sensation called throbbing, * * * perhaps one of the best characteristics of this species of inflammation. [This observation, as already noticed, (p. 23,) is incorrect.—J. F. S.] When the inflammation is moving from the adhesive state to the suppurative, the pain is considerably increased (and which would seem to be the extent of this operation in the part;) but when suppuration has taken place the pain in some degree subsides. * * * The redness that took place in the adhesive stage is now increased, and is of a pale scarlet: this is the true arterial colour, and is to be accounted a constant symptom, as we find it in all internal inflammations, when at any time exposed, as well as in those that are external." The dilatation of the old vessels, and the formation of new ones, which had occurred in the first or adhesive state of the inflammation, "are here carried still further in the surrounding parts, which do not suppurate, and constitute two other causes of this redness being increased by the vessels becoming more numerous, and the red part of the blood being pushed more forward into many vessels, where only the serum and coagulating lymph went before. The part which was firm, hard, and swelled, in the first stage, now becomes still more swelled by the greater dilatation of the vessels and greater quantity of extravasated coagulating lymph thrown out in order to secure the adhesions. The œdematous swelling surrounding the adhesive gradually spreads into the neighbouring parts. * * * There is a certain period in the inflammation, when the suppurative disposition takes place, which is discovered by new symptoms taking place in the constitution, viz. shivering." (p. 377–79.)

"The vessels are but little changed from the adhesive state at the commencement of the suppurative disposition; so that they still retain much of the form they had acquired by the first state, the discharge being at the beginning little more than coagulating lymph, mixed with some serum. This is scarcely different from the adhesive stage of the inflammation; but, as the inflammatory disposition subsides, the new disposition is every instant of time altering those vessels to their suppurative state; the discharge is also varying and changing from a species of extravasation to a new formed matter peculiar to suppuration; this matter is a remove further from the nature of the blood, and becomes more and more of the nature of the pus; it becomes whiter and whiter, losing more and more of the yellow and green which it is apt to give the linen that is stained with it in its first stages, and in consistence more and more viscid or creamy." (p. 415.)

JOHN HUNTER describes that as "an abscess *in* this part," *i. e.* when "collections of matter are found in parts where not formed, more especially in the deeper-seated ones, the matter moving from the seat where it was formed to some more depending part, or, having met with some obstruction in its course, it takes another direction;" whilst "abscesses which are commonly formed where matter is found, especially the more superficial ones, may be justly called abscesses *of* this part. (p. 510.) Suppuration takes place much more readily in internal canals than internal cavities; * * * more readily upon the surface of canals than in either the cellular or investing membrane. The same cause which would produce a suppuration in the first parts (the canals) would only produce the adhesive in the other (the cavities.)" (p. 377.)

" The cavity (of the abscess,)" observes TRAVERS, " is surrounded by an effusion, and lined by a pellicle of lymph (pyogenic membrane,) whence the pus is furnished." (p. 125.) " The aspect of the suppurating membrane varies to such extent as scarcely to exhibit, in some circumstances and situations, the granular form, *e. g.* upon the walls of abscesses, and upon the free surfaces of mucous and serous membranes; but the fibrinous bed and the capillary loop of new formation, and a corresponding alteration of the pus-secreting surface from its normal state will always be detected upon careful examination, being essential elements of the suppurative process." (p. 111.) " A section of an abscess, from circumference to centre, presents the condensation of the wall by the deposit occupying the cells of the cellular membrane, the secreting membrane, the semi-solid flakes of lymph, and the collection of pus forming its contents; the arrangement, appearance, and proportion of each varying according to the stage of the suppuration." (p. 125.)

(2) Of the circumstances upon which depends the determination of abscess to the surface, the following very interesting account is given by JOHN HUNTER:—" An internal pressure, produced by an extraneous body, acts equally on every side of the surrounding parts, and, therefore, every part being pressed alike, ought from this cause alone to produce absorption of the surrounding parts equally on all sides, supposing the parts themselves similar in structure, or, which is the same, equally susceptible of being absorbed; but we find that one side only of the surrounding living parts is susceptible of this irritation: therefore, one side only is absorbed; and this is always the side which is next to the external surface of the body. * * * From this cause we find abscesses, &c., whose seat is in or near the centre of a part, readily determined to the surface on the one side, and not on the other; and, whenever the lead is once taken, it immediately goes on." (p. 448.) He also observes:—" We find that the absorption of whole parts more readily takes place, to allow an extraneous substance to pass out of the body than it will to allow one to pass in. Thus we see that the slight pressure produced by matter on the inside of an abscess has a great effect, and the matter is brought much faster to the skin (although very deep) than it would by the same quantity of pressure applied from without; and, indeed, so slight a pressure from without would rather tend to have an opposite effect, namely, that of thickening. The reason of this is evident: one is, a readiness in the parts to be freed from a disease already existing; the other is a backwardness in the parts to admit a disease. This principle, therefore, in the animal economy produces one of the most curious phenomena in the whole process of ulceration, viz. the susceptibility which the parts lying between an extraneous body and the skin have to ulcerate, while all the other side of the abscess is not irritated to ulceration; and the necessity there is that it should be so must be very striking; for, if ulceration went on equally on all sides of an abscess, it must increase to an enormous size, and too great a quantity of our solids must necessarily be destroyed." (p. 449.)

But mere pressure is not, according to HUNTER'S views, sufficient for bringing the contents of an abscess to the surface; " there is an operation," says he, " totally distinct, and this is a relaxing and elongating process, carried on between the abscess and the skin, and at those parts only where the matter appears to point. It is possible that this relaxing, elongating, or weakening process may arise, in some degree, from the absorption of the interior parts; but there is certainly something more, for the skin that covers an abscess is always looser than a part that gives way from mere mechanical distension, excepting the increase of the abscess is very rapid." (p. 460.) TRAVERS, in commenting upon this point, observes:—" Whether the tendency of matter to the nearest surface, external or internal, the outer or inner integument, as the case may be, is due to the more yielding structure of parts in the direction of the nearest surface or to the operation of a physical law, as the increased amount of pressure from the increased area of the summit over the base, I cannot determine." (p. 188.)]

11. Pure good pus (1) is an opake, tolerably consistent, yellowish white fluid, with a peculiar smell when fresh, which it loses on cooling, and of a sweetish taste, specifically heavier than water, (spec. grav. 1,030,) (2), not readily subject to putrefaction (3); reacts in its fresh state as an alkali; but, after a time is neutral or acid, probably because during its decomposition it forms acetic acid; and under the microscope is seen to consist of *fluid parts* and *globules* (4) which can be separated by straining (5); but very frequently this separation occurs spontaneously if the pus be left alone.

[(1) Pus "is formed from some change, decomposition, or separation of the blood which it undergoes in its passage out of the vessels, and for effecting which the vessels of the part have been formed, which produces a subsiding of the inflammation from which it took its disposition. * * * In order to carry on the decompositions and combinations necessary for producing this effect, either a new or peculiar structure of vessels must be formed or a new disposition, and of course a new mode of action of the old must take place. This new structure or disposition of vessels I shall call glandular, and the effect or pus a secretion." (pp. 415, 416.)

"The purpose which the formation of pus serves in the economy is," says TRAVERS, "in conjunction with another act of inflammation, to open a communication with a contiguous surface, either for the purpose of liberating matter incapable of organization, and therefore superfluous or hurtful; or as indispensable to reconstruction or the effacement of lesions by granulation. (p. 118.) The continuance of inflammation, beyond the term required for union in simple solutions of continuity, in cases which are beyond reparation by the direct adhesive process, and in phlegmon or adhesive deposit unaccompanied by external lesion, entails an addition of the suppurative to the adhesive action. (p. 124.)

(2) The principal peculiar qualities of pus are its colour and consistence; but it appears that the colour takes its rise from the largest portion of the whole mass being composed of very small round bodies, very much like those small round globules which, swimming in a fluid, make cream. "I should suppose," says JOHN HUNTER, "those round globules to be white in themselves as cream would appear to be, although it is not necessary that the substances of matter which reflects a white, should be itself white. * * * These globules swim in a fluid which we should at first suppose to be the serum of the blood, for it coagulates with heat like serum, and most probably is mixed with a small quantity of coagulating lymph; for pus in part coagulates, after having been discharged from the secreting vessels, as mucus is observed to do; but, although it is thus far similar to serum, yet it has properties the serum has not." The fluid part of the pus would not coagulate on the addition of the gastric juice, or of solutions of neutral salts, but only with sal ammoniac, (hydrochlorate of ammonia,) "which would not coagulate any other of our natural juices." The proportion of the white globules in the pus "depends on the health of the parts which formed it; for, when they are in a large proportion the matter is thicker and whiter, and is called good matter." * * * Pus is specifically heavier than water: it is probably nearly of the same weight with blood or any other animal substance rendered fluid. It has a sweetish and mawkish taste, probably from having sugar in it, which is very different from most other secretions. It has a smell in some degree peculiar to itself." (p. 428–9.)

(3) With reference to the putrefaction of pus, HUNTER observes:—"Pus, from several circumstances often attending it, would appear in general to have a greater tendency to putrefaction than the natural juices have; but I very much suspect that this is not really the case with pure pus, for, when it is first discharged from an abscess, it is in generally perfectly sweet. There are, however, some exceptions to this; but these depend on circumstances entirely foreign to the nature of pus itself," (p. 434,) of which he instances the communication of the air with the interior of an abscess; the nearness of an abscess to the feculent contents of the colon, or rectum, when blood is contained in abscess resulting from external injury, or when part of the solids mortify from the same cause, and the like; "in all such circumstances we find the pus has a greater tendency to putrify than the pure or true pus," which, "although easily rendered susceptible of change by extraneous additions, is in its own nature pretty uniform and immutable. It appears so unchangeable that we find it retained in an abscess for weeks, without having undergone any change; but these qualities belong only to perfect pus." (p. 435.) Pus from sores, he remarks, is subject to the same changes under similar circumstances. GULLIVER also states, that he has had healthy pus "in a window, to which the sun had access for six weeks, without becoming fetid, and, if carefully washed of all impurities, it will continue sweet for an almost indefinite time" (*a*.)

(4) THOMSON says the globular structure of pus was first mentioned by SENAC (*b*). The following is, I presume, the passage to which he refers:—"The globules of pus are similar to those of the blood: such as are seen in the matter of which gonorrhœa consists are larger, whilst those which form the pus of ulcers are smaller and more unequal in size: but this figure does not give redness to these globules; they are white, and this whiteness is constant." (p. 659.)

JOHN HUNTER describes as "the peculiar character of pus, globules swimming in a

(*a*) Med. Gaz., N. S., vol. ii. p. 312. 1839–40.

(*b*) Traité de la structure du Cœur, et son action et de ses Maladies, vol. ii. Sup. Paris, 1749. 4to.

fluid which is coagulable by a solution of sal ammoniac, (hydrochlorate of ammonia,) which no other animal secretion he knew of is." (p. 421.)

(5) This does not accord with GUETERBOCK's (*c*) observation, who says, that "Pus of every kind and from any part may be separated into two parts, into a liquor and a substance, not soluble in it, but only suspended, rendering the pus turbid, and tinging it yellow; which, however, I could not completely separate by straining, although the most different papers were used. For the fluid always flowed turbid, and the paper through which I strained being obstructed, the pus, diluted with water, began in a short time to putrify. But, if you allow it to remain for a longer time in one vessel, you will find a supernatant yellow fluid, the greatest part of which, as will be shown hereafter, consists of albumen." (p. 8.)]

12. The fluid (serum) of pus shows no trace of globules: it exhibits all the signs of albumen dissolved in water, which is distinguished, like the serum of the blood from the white of fowls' egg in not being thrown down by æther. This fluid also contains *fat*, *osmazome*, *acetic acid*, perhaps also *lactic acid*, *hydrochlorate of soda*, *of potash*, *of lime*, *of ammonia*, (BONNET,) *phosphate*, *sulphate*, *and* probably also *acetate and lactate of soda*, *phosphate of magnesia and lime*, *a trace of iron and silica*.

HENLE (*a*) found free fat, recognisable by the microscope, in form of fatty vesicles.

Whether many substances which are found in pus, such as pyine, gluten, &c., are proper constituents of that fluid seems still doubtful; as also whether the iron is not to be ascribed to some admixture of blood.

[GUETERBOCK has entered into the chemical analysis of pus at very considerable length, (pp. 11, 19,) and he describes "a new substance of peculiar character," to which, "although found not only in pus, but also in mucus, without any intermixture of pus, and in tubercular matter, he gives the name *pyine*, (from πυος, *i. e.* formed of pus,) because he first discovered it in pus." (pp. 12, 13.) In the translation of GERBER's Elements of General Anatomy (pp. 97, 100) will be found the analyses of VOGEL, J. MARTIUS, GUETERBOCK, KOCK, GOEBEL, and DUMAS.]

13. The globules of pus vary in quantity, sometimes a larger, sometimes a smaller number being present; the thicker and better the pus, the more numerous are the globules. They are of two kinds; the larger have a diameter of 0,0004—0,0005 of a Paris inch; are of pretty uniform size, usually tolerably round, rarely of irregular form: most of them have an irregular surface, so that they appear as if covered with still smaller globules; they are more transparent and less coloured than blood-globules. Between these larger globules swim about a smaller quantity of little granules, rarely as large as blood-corpuscles. If the larger pus-corpuscles are for some time in contact with water, they become more transparent towards the edge, darker in the middle, and the same in spirits of wine. In acetic acid the envelope becomes transparent, finally dissolves, and leaves behind a nucleus consisting of one, two, or three corpuscles of 0,0001 of a Paris inch in diameter, many of which have a central indentation. Sometimes also the envelope bursts, and the nucleus is set free by shaking or rubbing. The envelope consists of albumen.

According to MANDT (as above) the larger pus-globules, in respect to their size form, appearance, and their relation to chemical agents, exhibit a perfect accordance with those globules which the coagulated fibrin presents, either in inflammatory buff, in false membranes, or in the fibrils, which fibrin forms when the blood is shaken about with albumen. MANDT applies to these globules the name *fibrin-globules*, because they owe their existence to the coagulated fibrin which is secreted from the blood and external to the vessels. The second kind of globules, the diameter of which varies from $\frac{1}{150}$ to $\frac{1}{300}$ of a millimètre, and which are mixed with the pus-globules, belong to the globules of albumen coagulated by the salts of the serum: they are, therefore, more

(*a*) De Pure et Granulatione Commentatio Physiologica. Accedit Tabula ænea. Berol., 1837. 4to.
(*b*) Symbol ad Anat. vill. Berol., 1837, p. 24, *note*.

numerous as the serum is more rich in salts. They are frequently found among fat-globules of different diameters.

[GUETERBOCK appears to be the first who discovered the different size of the globules in pus; he says:—"All writers who have hitherto examined pus, KALTENBRUNNER (*b*) alone excepted, (who mentions that he has seen corpuscles and granules swimming in the pus of frogs, although in pure human pus, carefully preserved from the air, he states that he has sometimes seen granules of equal size, (p. 16,)) speak of the globules swimming in pus as of only one kind. I have, however, always seen globules of vastly different size in pus, of which only the largest have been noticed by writers, even by GRUITHUISEN and E. H. WEBER. Although these exist in the greatest number in pus, yet it is not to be doubted that smaller ones swim among them. The proportions of the globules and liquor vary in every kind of pus, so that the greater be the number of globules the thicker and better is the pus, and *vice versâ*." (p. 8.) The size and form of the globules and granules given by CHELIUS are those stated by GUETERBOCK, who, subsequently comparing the globules in pus with the corpuscles of other animal liquors, says:—"They are most like the globules I have found in mucus, but more irregular, unequal, and of much less number, most of which are of the same size, and some even larger than the pus-globules, as I have frequently by repeated observations ascertained, notwithstanding E. H. WEBER contends they are only half as large. Like the pus-globule, they also contain a nucleus, consisting of granules. I have sometimes seen globules of the same form and nature swimming in the saliva; but at other times I have measured them twice and thrice as large. Mixed with water, they quickly swell and are decomposed. Finally, the pus-globules differ from the blood-corpuscles, not only in size, but also in chemical properties, since the envelope of the former is dissolved by both water and acetic acid, whilst that of the latter is dissolved only by the acetic acid." (p. 11.)

The following is the account which GUETERBOCK gives of the chemical nature of the pus-globules, which he obtained from a wound in a horse:—"The globules having been most carefully washed, and had concentrated acetic acid poured over them, were strained. In straining the envelopes of the globules were dissolved. On adding a solution of the ferro-hydro-cyanite of potash, a sediment was produced: the one part of it neutralized by the carbonate of potash was first rendered turbid and then precipitated, whence I conclude that the envelope is to be included among the number of those substances which, named by BERZELIUS albuminous, are precipitated by the ferro-hydro-cyanite of potash. But the granules forming the nuclei of the globules are not dissolved by acids. I cannot yet certainly state whether, like the corpuscles of the blood, they are dissolved by the liquor of caustic potash, though it seems to me very probable that they are; for the liquor of caustic potash (or even the concentrated carbonate of potash) being added, the pus-globules become more transparent, and are less perspicuous, some after a certain time vanish, rudiments of the envelopes and granules being here and there left." (p. 10.)

The pus-globules described by MAYO (*a*) as "occasionally seen in the blood of healthy persons," the only person in whose blood he had not found them being an aged woman of seventy-seven years, though he admits that "nevertheless they differ to a certain extent from the globules which are seen in pus from an ulcerated sore," GULLIVER (*b*) denies being pus-globules at all, and says they are probably the large white globules of the blood spoken of by MAGENDIE and Dr. DAVY.

The following is GERBER'S account of the formation of pus, and of the reproductive organization in suppurating wounds:—"A continual oozing of *liquor sanguinis* takes place on the surface of the wound; the coagulating fibrin forms exudation-corpuscles, which are partially disposed in layers on the wounded surface to form the exudation-membrane, and the layers nearest the living surface are converted into cells, which become further and differently organized according to the nature of the tissues to be reproduced. The cytoblasts or exudation-corpuscles most distant from the wounded surface become pus-corpuscles, which, with serum, form true pus, which on the one side covers the seat of organization, separates the so-called granulating surface from external influence, and on the other forms that soft, mild, peculiar medium in which reproduction proceeds from the wounded surfaces towards the middle of the wound, and by which foreign substances are washed out of the wound.

"*Pus.* The exudation-corpuscles lying beyond the living influence of the wounded surface, but exposed to external agency, cannot retain their life for any length of time, and,

(*a*) Observationes quædam microscopicæ in partibus animalium pellucidis institutæ de inflammatione. Dissert. inaug. Berol., 1835.
(*b*) Medical Gazette, 1839, 40, p. 128. (*c*) Ib. p 201.

forsaken by the organizing principle, degenerate in their organic formation, and their organic chemical blending; whilst those in contact with the living surfaces of the body, proceed in their further organization: thus, by the death of the former, is given life to the latter (*mors vitæ origo.*)

"Upon the free exudation-corpuscles first appear delicate radiating lines, which divide their periphery into six or eight (rarely more) segments: these lines become more decided, and the capsule appears as if torn, though without any solution of continuity. In some even the nucleus seems inclined to break into from two to four pieces. At the same time the originally reddish-yellow fluid fades, the divided segments of the capsule and the divisions of the nucleus, which were distinctly linear, become rounded into cohering granules, whilst the now perfectly formed pus is of a greenish colour. The true pus-corpuscles thus formed, are still here and there connected together, (the pus-membrane,) like the cells of tessellated epithelium; are specifically heavier than the serum; appear under the microscope somewhat larger than lymph-exudation and blood-corpuscles (from $\frac{1}{300}$ to $\frac{1}{170}$ of a Paris line in diameter;) are of a yellowish colour, and mingled with oil-drops and albuminous granules, with which last they are commonly besprinkled, and which are by many considered as integral parts of the corpuscles, they overlooking the usual large granules which in their connexion with the pus-corpuscles are so attached that the latter at first appear as lenticular, or cake-like quilted cushions. Subsequently the granules separate still more, so that the corpuscles are resolved into their elements; old pus therefore consists for the most part of these more or less isolated granules. * * * The younger the pus, the greater the quantity of fibrin (transition-cytoblasts) and the older it is, the more fat does it generally contain. Thus, in the degeneration of its organization, from its commencement to its perfection, is it remarkably opposed to chyle, in reference to its organic and chemical relations." (pp. 47, 48.)

"*False Pus.* Secreted and exuded fluids very frequently occur in man and beasts, which without closer—that is, microscopic—examination, may be taken for pus, because they look very like it, and chemically often do not differ much from it, and yet are produced in another way, and are of different nature. On the contrary, substances are deposited and thrown out which seem very different from pus, and yet are either true pus, or very nearly allied to it.

"It is the above-described fluid alone, the true or proper, the so-called laudable pus, which is a necessary condition of reproduction: therefore I call it *reproductive pus;* and, as the corpuscles usually consist of seven granules, they may also be called septengranular pus-corpuscles. Previous to their division, these corpuscles always belong to the nucleated corpuscles; they are degenerating cytoblasts. In this constant quality of the true pus-corpuscle is the most certain criterion for distinguishing pus from other more or less similar fluids; and that fluid which contains no such corpuscles, or with them any corpuscles or deposit which do not exist in the pus of healthy wounds, is either not pus, or not pure pus." (pp. 53, 54.)

The following are TRAVERS's views on the constitution of pus:—"Pus, I believe," says he, "to obtain its characters of consistency, opacity, and colour after exudation, and to consist of the superfluous or waste lymph which has been separated during the adhesive stage from the mass of blood held in solution by the serum, being thus a chemical modification of the constituents of the *liquor sanguinis;* in short, the latter fluid deprived of its original character and property of spontaneous coagulation. Pus particles resemble those of lymph seen in the vessels under inflammation, except that they appear broken down and partly dissolved in their texture instead of compact and of less regular figure; and, if when suspended in a drop of fluid, compared with the elastic blood-corpuscle, to which they bear no analogy whatever, utterly inert and devitalized. We never see pus in the blood-vessels but in fatal phlebitis, and, if introduced into the circulation by injection, it is destructive to life. Although, therefore, a clean-wiped granulating surface soon presents a covering of pus, it is exuded as a colourless fluid of a more dense and unctuous consistence than serum. Its appearance is simultaneous with the disappearance of the lymph-particle from the veins, the suppurative action being determined, or, in other words, the separation of the proper lymph-particle put an end to by its sufficient deposit in granulation, and the inflammatory nisus still prevailing from the continuance of the irritation, for no imperfect state can be perpetuated; the superabundant lymph-particle, at no time coloured, along with the permanent fluid or serum of the blood, is strained off through the pencils, forming the terminal loops of the granulation. Thus is obtained the twofold purpose of relief to the loaded capillary circulation, and a bland and homogeneous protecting fluid for the granulation during the period of its growth up to that of final organization. When the rudimental fibrin is no longer needed for the new structure, it is used, as in nature all remnants are, for

a new but not less important purpose,—the preservation of that structure. Pus is as necessary to the maintenance of granulation as lymph was to its formation; but a change is necessary to fit it for its new function, and this is provided for by a new arrangement of a new action of the secreting capillaries, and a chemical change, which destroys its vital property and amalgamates the separated lymph-globules with the serum of the blood. The precedence of adhesive to suppurative action is sufficient to render presumable a necessary connexion between the lymph separated during the first process, and afterwards disappearing, and to explain the invariableness of this relation in the order of their appearance. There is no analogy between the effusions of serum or of *liquor sanguinis* incidental to primary wound or injury of any kind and pus, yet the ingredients of the two latter are the same: it is by the combinations of a vital chemistry that their appearance and sensible properties differ, and this we are capable of imitating. If this theory be admitted, it will explain the appearance of pus in the absence of the especial granular structure or distinct pyogenic membrane, as seen upon mucous, serous, and synovial surfaces and canals; and, even in the absence of fibrinous exudation, as in certain modes of inflammation, where the habit of the parts or the character of the inflammation renders them incapable of carrying on the adhesive action, or that action is by violence interrupted. Puriform mucus, muco-purulent secretion, are terms in common use, indicating the transition stage witnessed in these cases; so also the modifications of colour, consistence, and purity are explained, which are conveyed by the terms sanious, flaky, or whey-like, ichorous, &c., and the improvement of the secretion by elaboration from that of fistulæ and sinuses to the 'pus laudabile' of old authors concurrent with the improved vitality of the granulations, meaning a fuller proportion of the lymph-particle to the serum, and *vice versâ*, its degeneration in enfeebled and sinking states of the system. Thus also is explained the effect of inordinate and excessive suppuration to superinduce hectic, from the excessive withdrawment of that ingredient which forms the nutrient and restoring principle of the blood. * * * The conversion of the blood-corpuscle into the pus-corpuscle is a notion altogether gratuitous and unsupported either by appearance or probability; and, to my mind, the above is a theory more reconcilable with all the circumstances attending its origin than that which supposes *de novo* formation of the pus globules. But the wounds of cold-blooded animals not being subjected to the true suppurative process, nor those of mammalia and birds disposed to free suppuration, there appears to be insuperable difficulty in establishing this theory by actual demonstration." (pp. 172, 6.)]

14. The nature of the pus varies considerably according to the nature of the parts in which it is formed, according to the constitution of the person, according to the degree and character of the inflammation; it may be changed by other fluids, mingled with it. We distinguish good cream-like, uniformly consistent, yellowish white, inodorous pus, (*pus bonum et laudabile*, Lat.,) thin, mucous-like, serous, grayish, greenish, brownish, and more or less fetid pus (*sanies*, *ichor*, Lat.; *Jauche*, Germ.) (1). These varieties of pus, as well as the fluid products of inflammation especially, depend merely on the different proportions of the materials composing it. All these products are derived from the blood, and in them are found all the same materials as in the blood, excepting fibrin. Thus is it clear why chemical and microscopical examination cannot ascertain any determinate difference between the products of inflammation and the serum of the blood, the mucus, the serum from dropsy, the yellowish white fluid (*materia puriformis*) poured out from inflamed mucous membranes (2); the thin, lymph-like fluid which exudes from inflamed serous membranes (3) and the various kinds of pus appear to be compounded in the same way. Their difference consists only in the different proportions of the several substances, in their disposition to organization, and in the greater or less advanced degree of plastic activity (4).

The presence of globules in the serum has been long since proved by BAUER and FARADAY (*a*), as also by MANDT and others in the various effusions and serosities which occur in the cellular tissue and in the serum of dropsy; but the albumen in pus is in

(*a*) See HOME on the Conversion of Pus into Granulations or New Flesh, in Phil. Trans. 1819, p. 2.

a higher degree of coagulation, is opake, of tolerable consistence, and coagulates less by warmth, and by the concentrated acids. The difference between creamy, consistent, and thin serous pus depends entirely on the different proportions of the fluid and of the pus-globules. BONNET, (as above,) who seems not to know the pus-globules, derives this difference from the greater proportion of the emulsive fat in the former and its smaller proportion in the latter. We may give every kind of pus that semi-transparency, that stringy character, that adherence of its parts which seem especially proper to mucus, if we mix and shake it up with a solution of hydrochlorate of ammonia, whereby the proportion of one of its components is increased. The consistence of pus is to a certain extent influenced by the length of time it has been retained in the body, the absorption of its fluid part thereby occurring, and in suppurating surfaces perhaps also by the influence of the air, as, in the latter case, when the pus is washed off clean, a clear serous fluid is always observed to ooze up. In this manner we may judge of the various tests of pus, for the purpose of distinguishing it from mucus. According to GRASSMEYER (*a*), if pus be mixed with twelve parts of distilled water and one part of *liquor potassæ*, a viscous transparent jelly capable of being drawn into thread is formed, more quickly or more slowly according to its different composition. According to GRUITHUISEN'S microscopic examinations (*b*), pus exhibits white spherical granules slightly dotted upon the surface, which after some hours fall, and even preserve their round form in pus which has been dried and again moistened. In mucus these granules only appear when it is previously thinned with pure fluid: the granules in mucus are less numerous and dark-coloured. FISCHER (as above) holds it best, in order to determine the presence of pus and mucus, to mix and shake together the questionable matter with two or three parts of *liquor potassæ* or *liquor ammoniæ caustici*, and then to add hydrochlorate or nitric acid to neutralisation. If it contain pus, there will be produced by the continued addition of the acid a whitish flocculent sediment.

[(1) "Ichor," says GERBER, "has very various colours, and is generally more fluid than pus. The ulcer is a wound with a dead surface incapable of throwing out or organizing plastic lymph, bedewed with a depraved serum (*ichor*) destructive of every exudation. This ichor acts injuriously on the ulcer, destroying it and eating into the neighbouring vessels: hence the discharge of small quantities of blood, which is immediately discoloured in the ichor, and so much changed that the *liquor sanguinis* rarely coagulates, save in granules; the blood-corpuscles appear puffed up, corroded superficially, divided into irregular pieces or even shrivelled up. The blood-corpuscles thus altered are denominated *ichor-corpuscles:* they are commonly covered with granules attached to them or partially lying on them; their character is ascertained in the discharge of glanders which principally consists of them." (p. 56.)

(2) "Puriform mucus, secreted in the last stage of catarrhal affections, varies according to the extent of reproduction which the affected mucous membranes require. Should the mucous glands and follicles be altered in a less degree than the cuticle, which after catarrhs is always produced afresh, then the mucus, besides the usual mucous corpuscles and granules, contains, instead of the usual older elements of the epithelium, which are large, squamous, granulated, epithelial cells or cylinders, a large addition of newly-formed small lenticular cells, in which the nuclei are often recognised with difficulty; hence rendering them very like large exudation-corpuscles. Sometimes among these young epithelial cells true pus-corpuscles are observed, when any part of the mucous membrane needs reproduction." (p. 54.)

(3) "In serous exudations," he proceeds, "it is usual to find albuminous granules in albuminous fluids, and, if a great part of the serum be again removed by absorption, the crystals of different salts. * * * After plastic exudations, a yellowish turbid fluid is found in the affected cavities containing fine flocculi of a pale yellow colour: these are partially precipitated upon the walls of the cavity, which appear bestrewed over the whole extent of the exudation." (p. 42.)

The distinguishing characters of true Pus and Ichor have been already mentioned.

(4) This statement of our author, "that chemical and microscopical examination cannot ascertain any determinate difference between the products of inflammation and the serum of the blood," &c. &c., and that "their difference consists only in the different proportions of the several substances," &c. &c., is rather too hasty, as the extracts just quoted from GERBER on the subject show that there is a well-marked distinction among them.—J. F. S.]

15. Pus cannot be produced without inflammation; but the latter may

(*a*) Abhandlung von dem Eiter und den Mitteln, ihn von allen, ihn ähnlichen Flüssigkeiten zu unterscheiden. Götting., 1790.

(*b*) Naturhistorische Untersuchungen über den Unterschied Zwischen Eiter und Schleim. München, 1809.

exist in so slight a degree as to be scarcely, or even not at all, observable, and, on account of the too slight vital activity of the organ, the low state of the nervous power, and of the plasticity of the blood and the diseased diathesis, a serous thin pus is produced without the appearances of inflammation being manifest. The circumscription also of the pus in a definite cavity proves that inflammation must have been present. Abscesses thus originating are called *Cold Abscesses*, *Lymph Abscesses* (*kalte Abscesse*, *Lymph Abscesse*, *Lymphgeschwülste*, Germ.; *Abcès froid*, Fr.) They are always the consequence of a general cacochemic or dyscracic affection, and arise either spontaneously and commonly in many places at once, or are produced by an external injury.

We may very properly apply with WALTHER the name *Diathesis purulenta* to that general condition of the body which is the ground of these abscesses; but it is improbable that pus can be formed in the blood itself by decomposition within the vessels, and that the blood can be immediately converted into pus. The circumstance of pus having been found in the blood, cannot form a ground for this opinion, as this, if the walls of the veins are not inflamed, intimates merely the absorption of the pus which has been found as well in the lymphatic vessels as in the veins (*a*). The so-called *abscess of congestion*, in which the source of the pus, mostly the carious destruction of bone, is more or less distant from the collection of pus upon the surface of the body, must be distinguished from cold abscess: this, however, will be considered in several places.

16. The commencement of cold abscess usually sets in, without any sensibly perceptible local appearance, with diminution of appetite, general uneasiness, slight fatigue, disturbed sleep, and so on. Next there appears on some part of the surface of the body, (where many patients fancy they have had a sort of prickly sensation,) most commonly between the shoulder-blades, on the chest, on the loins, on the upper part of the thighs, a little, not discoloured, elastic, scarcely fluctuating swelling, which is not painful, and at the utmost gives the patient an obscure sensation of tension and weight. Gradually the swelling enlarges, often to a considerable size, the fluctuation is distinct, and the symptoms of a disturbed assimilation become more marked. After a shorter or longer time, the swelling begins to be painful, the skin covering it reddens, becomes tense, the general appearances mentioned are more decided, febrile action sets in, and the whole countenance of the patient is cachectic. The skin, continuing to thin, at last breaks, and a quantity of thin, pus-like, often completely putrid and stinking, fluid is evacuated, followed by a clear discharge, which, if the neighbouring bone be destroyed, is of an ichorous character. By this great loss of the juices, and by the colliquative sweats and purging, which soon set in, the powers of the patient are speedily broken up.

[The cold abscess here described must be confounded neither with HUNTER'S "collections of matter without inflammation," (p. 390,) which are, as he says, of a scrofulous nature, and very different from that under consideration, nor with "the cold abscess of the surgeons of the Saracen school, the chronic abscess of modern surgeons," mentioned by BOYER and CRAIGIE (*b*) (pp. 43—163), and caused by *chronic inflammation*.

The true cold abscess, which CHELIUS has here well described, is, I believe, very rare. I have recently had a case of which the following is a brief account:—

Philip Coyne, aged 26, admitted under my care,

August 27th, 1844. He was very irritable, complained of much lassitude and debility, and that he had some difficulty in passing his water, for which about a fortnight ago he had a catheter passed, but had not been since inconvenienced. He did not, upon examination, appear to have any surgical complaint; but, as he had been ill-fed, and suffering

(*a*) See CRUVELHIER, Anatomie Pathologique, vol. i. p. 200. GENDRIN, as above, p. 22.

(*b*) Elements of General and Pathological Anatomy. Edinburgh, 1828. 8vo.

privation for some little time before his admission, I kept him in the house for charity's sake, though I suspected he was feigning illness. He, however, grew worse, had a hot skin, with much perspiration, loss of appetite, pains in his joints; and, again complaining of difficulty in passing his water, which was not, however, caused by any stricture, I considered therefore his case to be medical, and, on

September 3rd. He was transferred to Dr. Burton's care, who treated him with sulphate of quinine and citrate of iron, with a colocynth and calomel pill occasionally. He continued growing worse, and, on

September 10th. I was requested to see him again, when he still complained of difficulty in voiding his urine, and had a largely diffused swelling extending over the whole right inguinal region, without redness, with little pain, but with distinct fluctuation, and extending down behind the right spermatic cord into the scrotum, which was so little protruded that the swelling there was only accidentally discovered. The swelling in the groin, which was only noticed yesterday or the day before, is quite subcutaneous. I made a puncture a little above the middle of Poupart's ligament, and drew off a pint of healthy, sweet-smelling pus, and the swelling in the purse subsided as it flowed. Half a grain of acetate of morphia nightly was ordered, to give him rest, which he much needed.

On the following day he was better, and a mutton chop with porter daily was ordered.

September 13th. There is little discharge from the puncture; but he now points to another subcutaneous abscess without redness and with little pain, beneath the spongy body of the penis, which was opened, and a table spoonful of good pus voided. He complains of much tenderness in the left knee, to which bran poultice was ordered.

September 14th. But little discharge from either opening. Since yesterday a large diffused swelling has presented on the left side of the chest, below the arm-pit, without redness, but tender and with indistinct fluctuation.

September 16th. The abscess just mentioned was opened, and four ounces of good pus discharged. He now points to another diffused swelling, without redness, on the front of the right shoulder, which fluctuates indistinctly. There is but little discharge from the groin. For the last two days he has been taking ammoniated citrate of iron, five grains, with a drachm of compound spirit of ammonia in infusion of quassia thrice a day. I ordered him, in addition, half a pint of port wine, as he sweats very profusely, has a quick, feeble pulse, and is very weak and thirsty.

September 17th. The abscess on the shoulder was punctured, and about an ounce of pus discharged. The sweating still continuing, he was ordered to take of dilute nitric acid ten drops in infusion of roses, thrice a day.

On the following day, being nauseated and a little sick, a draught of peppermint water with a drachm of sulphuric æther was ordered, but it did not do him much good, and, on

September 19th. He was ordered, instead, five minims of dilute hydrocyanic acid in water, a mustard poultice to the region of the stomach, and four ounces of brandy daily, instead of the wine. The abscesses on the shoulder and chest discharge freely; but those below are healed.

September 27th. On the whole, somewhat better; but the discharge is still very profuse. There is now much fluid in the mucous bag behind the insertion of the *m. rectus femoris*, and the knee is very tender: the bran poultice was discontinued, and a blister ordered, with a poultice afterwards.

October 8th. Has not materially improved, and is now attacked with diarrhœa. Ordered fifteen minims of nitro-muriatic acid three times a day.

October 9th. The diarrhœa continues, and is now accompanied with sickness. The acid to be left off, and in its stead fifteen grains of carbonate of potass, with compound tragacanth and acacian gum powder in clove water, with compound spirits of ammonia and tincture of cardamoms, every four hours.

October 21st. On the whole, better; but little discharge from the abscesses; the knee unimproved.

October 28th. Another blister applied to the knee.

November 2nd. The knee considerably swollen and painful; an issue to be put in above and below the joint.

Having got into a very awkward and uneasy posture, his left leg being laid completely on the outside, and not moveable without great pain, I thought it advisable to get the limb on an amesburg, and gradually from day to day to raise it up till on the heel. This was effected in the course of a few days, and rendered him much more comfortable, and the knee diminished in size, as the issues began to discharge. He never, however, rallied, but gradually continued drooping, became very excitable and so weak that he continually passed his motions beneath him. A patient's death near him had very much

troubled him during his illness, and, another having died on 22nd December, he again became alarmed, and sunk on the following morning without any other especial cause.

The examination of the body on the third day after death presented the following remarkable and unexpected appearances, as he had never made any complaint, nor had the attendants more than myself noticed any circumstance which could lead to the expectation of the results which occurred.

The body generally was thin, but not much emaciated. The slough on the rump had exposed a large portion of the sacrum. Between the crest of the right ilium and the great trochanter, the soft parts were prominent and fluctuating.

The heart and lungs were perfectly healthy.

All the abdominal viscera were healthy except the liver, which was much enlarged, and extremely pallid, and had degenerated into fat to an extreme degree.

The right *m. iliacus* was raised from the concavity of the ilium; prominent, tense, fluctuating when touched, and the fluctuation communicated to the external prominence between the iliac crest and trochanter. When the muscle was cut into, a large quantity of dirty stinking pus was found filling the iliac pit internally, and communicating through the ischiatic notch, of which the edge had become carious and rough, with a quantity of similar pus extravasated among the gluteal and all the muscles in the neighbourhood of the back of the hip-joint. All the muscles were separated from each other, and had assumed a greenish appearance. In front of the joint there was only a small collection of pus, and the muscles were seemingly healthy. The hip-joint contained a small quantity of dirty purulent fluid; there were slight traces generally of synovial inflammation, specially at the notch, and where the acetabulum was devoid of cartilage. The right ilium was rough and carious on both external and internal surface, and the right sacro-iliac symphysis so extensively destroyed that slight force separated the bones, the surfaces of which were carious.

The left knee-joint: nearly all the articular surfaces deprived of their cartilage, small isolated patches alone remaining, and the exposed surface of the bone being everywhere rough and carious. The crucial ligaments were only partially destroyed.

Neither of the vertebral bodies were affected with disease.—J. F. S.

My friend Dr. RIGBY (*a*), in his account of contagious or adynamic puerperal fever, speaks of a peculiar kind of abscess following attacks of that disease, which we saw together in several instances at the General Lying-in Hospital. "Where," says he, "the constitution has borne the brunt of the attack without immediate collapse, and the local mischief been controlled by appropriate means, we find that fresh efforts are made to rid the circulation of the morbid matter with which it is infected. The patient is suddenly seized with severe pain, with heat, redness, and swelling of one of the large joints, presenting all the appearance of arthritic or rheumatic inflammation, and also of certain muscles especially, the supinatores of the arm, the glutæi and gastrocnemic. The painful spot soon becomes hard, it is intensely tender, and in two or three days the feeling of fluctuation indicates the formation of an abscess, from which a large quantity of greenish coloured pus mixed with blood and serum, is discharged. The cellular tissue beneath the skin and between the muscles is equally affected, and, if examined when the abscess is just beginning to form, will be found of a dirty brown colour, softened, infiltrated, and here and there condensed with lymph or pus, precisely as in cases of gangrenous erysipelas: the muscular tissue has entirely lost its red colour, and closely resembles the appearance of boiled meat, its structure so softened as to tear easily under the fingers, and interspersed with deposits of immature lymph and purulent fluid, the commencement of what would have been an abscess. Like gangrenous erysipelas, the extent of the abscess does not seem to be limited by a surrounding wall of healthy lymph, as seen in a common phlegmon, but, if deep beneath the surface, it continues to spread in all directions, until nearly the whole limb appears to be implicated in one immense abscess: hence, in those patients who have recovered under these attacks, the limb has frequently been rendered useless, the muscles being atrophied and coherent." (p. 291.) The following observation of the same writer in reference to the contagious nature of these abscesses is extremely important. "That the discharges from a patient under puerperal fever are in the highest degree contagious, we have abundant evidence in the history of lying-in hospitals. The puerperal abscesses are also contagious, and may be communicated to healthy lying-in women, by washing with the same sponge; this fact has been repeatedly proved at the Vienna hospital; but they are equally communicable to women *not pregnant:* on more than one occasion the women engaged in washing the soiled bed linen of the General Lying-in Hospital, have been attacked with abscesses in the fingers or hands, attended with rapidly spreading inflammation of the cellular tissue." (p. 292.)]

(*a*) A System of Midwifery, Lond., 1844, forming part of TWEEDIE's Library of Medicine.

17. BEINL, RUST, and others, consider the nature of the so-called lymph-swelling to be an *extravasation of lymph*, depending on a rupture of the lymph-vessels, or on an unnatural extension of their walls, and they explain the gradual sinking of the powers of the constitution and so on, which occur at the latter period of the disease, and after its bursting, by the continued loss of the lymph (*a*). The observations made on the fluid contained in these swellings (which RUST imagined to be only in the earlier period of the disease, transparent and colourless) have shewn that it has more of the properties of pus than of actual lymph, and WALTHER has decidedly proved that the acceptation of the term lymph-swellings in the sense just mentioned is inadmissible; that they must be considered only as abscesses (*lymph-abscesses*) preceded by a stealthy, if not a sensibly perceptible, inflammatory condition, which, however, on account of the too much depressed vital activity, could not produce a plastic consistent pus, but only a secretion of a thin more or less turbid lymphatic fluid. The opinion advanced by BEINL that the strongest and most healthy subjects are commonly more subject to this disease than the weakly, that men more than females, and that, without an external injury, a general diseased condition is incapable of producing a lymph-abscess, is incorrect, and has been disproved by RUST. How frequently, even by writers on lymph-swellings, cold abscesses and such collections of pus as have formed at distant parts (*congestion-abscess*) (*b*), in consequence of carious destruction of the bones of the vertebral column, have been taken for lymph-swellings, and treated as such, I myself have frequently observed.

NASSE (*c*) describes a case in which a powerful healthy young man, in consequence of an external injury, had a swelling formed on the upper part of the thigh, the contents of which, after opening, perfectly resembled lymph. The pouring out of a clean transparent fluid could not be allayed by any treatment recommended for lymph-swellings, and the patient was exposed to the danger of hectic consumption. The local use of a solution of nitrate of mercury alone brought the lymph-vessels to close. This case (which I myself saw, although only once, in passing through Halle, and convinced myself of the continued outflowing of clear lymph which could be increased by pressure) proves that a collection of lymph in the cellular tissue is possible, as the consequence of an actual tearing of lymph-vessels by external violence, the exudation from which ceases only by obliteration of the torn vessels. Cases of this kind are, however, undoubtedly very rare; to them alone can be applied the term *lymph-swelling* in its proper sense, and therefore the above advanced opinion, "*that the cases commonly spoken of as lymph-swellings are merely modifications of abscesses*," is rather confirmed than contradicted. This opinion LANGENBECK (*d*) has also advanced; although, he adds, that not unfrequently a swelling is observed on the elbow, which is formed sometimes from a local cause, and sometimes also without, is situated immediately on the olechranon, and contains a clear lymphatic fluid enclosed in a cyst, which deserves the name of lymph-swelling, I must yet deny this assertion, as this swelling at the elbow joint is a dropsy of the mucous bag there situate, and may be compared to the *Hygroma cysticum patellare*. Just as little also can I agree with the opinion of EKL (*e*), who considers the lymph-swelling as an expanded mucous bag in which there is a diseased secretion going on. ZEMBSCH (*f*), according to KLUGE, in order to accommodate the different opinions of writers, distinguishes, 1st, the acute and chronic lymph-swelling, as idiopathic and symptomatic disease; 2nd, the false lymph-swelling or lymphatic abscess.

[A case marked in my note-book, "Collection of synovial fluid within the femoral sheath," which occurred in St. Thomas's Hospital in 1839, seems to me more nearly allied

(*a*) J. A. SCHMIDT, über den Grund der Todtlichkeit de Lymphgeschwülste; in Abhandlungen der Medic. Chirurg. Jos. Akademie in Wien, vol. ii.

(*b*) A. PAULI, Bemerkungen über Congestions abscesse; in RUST's Magazin, vol. vii. p. 383, vol. viii. p. 434.

(*c*) Archiv für medicinische Erfahrung von HORN, NASSE, und HENKE, vol. i. 1817, p. 377.

(*d*) As above, vol. ii. p. 197.

(*e*) Bericht über die Ergebnisse; in Chirurg. Klinikum zu Landshut. Landshut, 1824. 4to.

(*f*) Ueber du Lymphgeschwülst; in RUST's Magazin, vol. xxvii. p. 1.

to the lymph-abscess of this paragraph, of which I was then ignorant than to a collection of synovia, as I thought it perhaps might be. The patient was a healthy country lad, seventeen years old, who three years previously had received a blow on the upper outer part of his left thigh, but seemed to have recovered from its effects. Two months since he noticed a swelling on the outside of the same thigh, about a hand's breadth above the knee-cap, which gradually increased both downwards and upwards, so that at his admission it occupied the outer and fore part of the thigh, from a little above the knee to near the great trochanter, fluctuated distinctly, and was presumed to be an abscess in the outer chamber of the femoral sheath. Fifteen minims of tincture of muriate of iron in mucilage thrice a day were ordered, to excite absorption, which was continued for nearly three weeks without benefit. The thigh then having increased, and fluctuation and swelling having extended about the whole knee, I made, by the direction of my then colleague TRAVERS, whose patient he was, an incision two inches long, about the middle of the outside of the thigh, expecting to evacuate pus or open the femoral sheath; but neither pus nor any other fluid escaped, although I cut into the *m. vastus externus* an inch deep. A tent of lint was left in the wound to keep it open, and hasten the escape of pus if any should make its way through the wound; but none appeared, and in the course of a fortnight the wound had entirely healed. The tincture of iron, which had been continued to this time, was now left off, and two grains of iodide of iron thrice a day, ordered in its stead. A week after the whole thigh was wrapped in mercurial ointment, and swathed in a roller. This treatment was continued for three weeks, but without any diminution in size, or apparent change; fluctuation was still very distinct, and the fingers of one hand being applied, whilst pressure was made with the other hand alternately above, a thrilling fluctuation was felt. It was therefore determined to introduce a grooved needle about the middle of the thigh, and some fluid very similar to synovia escaping by it, an abscess lancet was then, with my colleague's consent, thrust in, making an opening an inch long in the skin, and half its length in the sheath, from which escaped about twenty ounces of the seemingly synovial fluid, which nearly emptied the cavity, leaving a rather moveable lump about the middle of the fore part of the thigh, the character of which I could not make out. The edges of the wound were carefully brought together, the limb rolled, and in four days union had taken place. A week after another free puncture below the former voided a quart of the same fluid as before, and on applying heat it coagulated speedily and almost entirely. The wound was left open, and a roller applied above and below it; but in the course of a week it had again united, and fluid was again secreted, though in smaller quantity. A solid but moveable swelling had at this time also formed to some extent around the wounds. The iodide of iron was then omitted, and, instead, was ordered decoction of sarsaparilla four ounces, with five grains of iodide of potash twice a day; the whole thigh to be enveloped in ointment of iodide of potash. Three weeks after the solidification had increased, and the fluctuation generally was less distinct, and soon after the ointment was given up, and mercurial plaster applied. Two months after, having begun to take the iodide of potash, the thigh had much diminished, there was less fluctuation, the middle outer skin was almost solid, and there is less effusion about the knee. The diminution of size and fluctuation continued, and in about two months he was able to walk about. He continued with us about four months longer, and, when he left the house, the swelling about his knee, although not completely subsided, had so considerably diminished as not to interfere with his walking.—J. F. S.]

18. Ulceration (*Exulceratio*, Lat.; *Verschwärung*, Germ.; *Ulcération*, Fr.) is distinguished from suppuration, in being connected with an actual destruction of parts, (by ulcerative absorption,) and with the secretion of a thin, acrid, fetid, and variously coloured pus-like fluid. It arises either immediately from inflammation, or from a preceding abscess. Its causes are either local injury,—for instance, improper treatment of the abscess which has been opened,—or general disease, as scrofula, syphilis, and so on.

[In considering the subject of ulceration, or "ulcerative inflammation," as he most properly calls it, HUNTER first indicates the economy of the absorbent vessels, and speaks of them in two views: first, as they absorb matter, which is not any part of the machine; secondly, as they absorb the machine itself." The former of these functions is of two kinds, of which the one absorbs external matter, either applied to the skin or received into the alimentary canal; and the other takes up internal matter, as many

of the secreted juices, the fat and the earth of bones, &c.; both, however, serve principally to the nourishment of the body as well as to other and even hurtful purposes. The second function, that of "removing parts of the body itself, * * * may be viewed in two lights." The one view presents them as causing "a wasting of the whole machine or part, * * * which I call *interstitial* absorption, because it is removing parts of the body out of the interstices of that part which remains, leaving the part still as a perfect whole. But this mode is often carried further than simply wasting of the part; it is often continued till not a vestige is left, such as the total decay of a testicle." The other view exhibits them as "removing whole parts of the body," and "may be divided into the natural and diseased." Under natural circumstances the absorbents "are to be considered as the modellers of the original construction of the body;" for "no alteration can take place in the original formation of many of the parts, either in the natural growth, or that formation arising from disease, in which the absorbents are not in action, and take not a considerable part: this absorption I shall call *modelling absorption*. * * * Absorption, in consequence of disease, is the power of removing complete parts of the body, and is in its operation somewhat similar to the first of this division or modelling process, but very different in the intention, and therefore in its ultimate effects. This process of removing whole parts in consequence of disease, in some cases, produces effects which are not similar to one another; one of these is a sore or ulcer, and I therefore call it (the absorption) *ulcerative*. In other cases no ulcer is produced, although whole parts are removed; and for this I have not been able to find a term; but both may be denominated *progressive* absorption. * * * * * It may be difficult at first to conceive how a part of the body can be removed by itself; but it is just as difficult to conceive how a body can form itself, which we see daily taking place; * * * but this I may assert, that wherever any solid part of our bodies undergoes a diminution, or is broken in upon, in consequence of any disease, it is the absorbing system which does it. When it becomes necessary that some whole living part should be removed, it is evident that nature, in order to effect this, must not only confer a new activity on the absorbents, but must throw the part to be absorbed into such a state as to yield to this operation. This is the only animal power capable of producing such effects, and, like all other operations of the machine, arises from a stimulus or an irritation; all other methods of destruction being either mechanical or chemical. The first by cutting instruments, as knives, saws, &c.; the second by caustics, metallic salts, &c. The process of ulceration is of the same general nature in all cases; but some of the causes and effects are very different from one another." (pp. 440, 2.) "This process of the removal of parts of the body, either by interstitial or progressive absorption, answers very material purposes in the machine, without which many local diseases could not be removed, and which, if allowed to remain, would destroy the person. It may be called in such cases the natural surgeon. It is by the progressive absorption that matter or pus, and extraneous bodies of all kinds, whether in consequence of or producing inflammation and suppuration, are brought to the external surface; it is by means of this that bones exfoliate; it is this operation which separates sloughs; it is the absorbents which are removing old bones, while the arteries are supplying new ones; and, although in these last cases of bones it arises from disease, yet it is somewhat similar to the modelling process of the system in the natural formation of bone; it is this operation that removes useless parts, as the alveolar processes when the teeth drop out, or when they are removed by art; as also the fangs of the shedding teeth, which allows them to drop off; and it is by these means ulcers are formed. It becomes a substitute in many cases for mortification, which is another mode for the loss of substance; and in such cases it seems to owe its taking place of mortification to a degree of strength or vigour superior to that where mortification takes place; for, although it arises often from weakness, yet it is an action, while mortification is the loss of all action. In many cases it finishes what mortification had begun, by separating the mortified part. These two modes of absorption—the interstitial and the progressive—are often wisely united, or perform their purposes often in the same part which is to be removed; and this may be called the *mixed*, which I believe takes place in most cases, as in that of extraneous bodies of all kinds coming to the skin; also in abscesses, when in soft parts. It is the second kind of interstitial absorption, the progressive and the mixed, that become mostly the object of surgery, although the first of the interstitial sometimes takes place so as to be worthy of attention. This operation of the absorption of whole parts, like many other processes in the animal economy, arising from disease, would often appear to be doing mischief, by destroying parts which are of service, and where no visible good appears to arise

from it: * * * but in all cases it must still be referred to some necessary purpose; for, we may depend upon it that those parts have not the power of maintaining their ground, and it becomes a substitute for mortification; and, indeed, in many ulcers we shall see both ulceration and mortification going on; ulceration removing those parts that have power to resist death." (pp. 444, 5.)

As regards "the absorption of whole parts from disease, it would appear," says HUNTER, "that they are capable of being absorbed, from five causes: first, from parts being pressed; secondly, from parts being considerably irritated by irritating substances; thirdly, from parts being weakened; fourthly, from parts being rendered useless; fifthly, from parts becoming dead." (p. 446.)

"The dispositions of the two parts of the living body, which absorb and are absorbed, must," says HUNTER, "be of two kinds respecting the parts; one passive and the other active. The first of these is an irritated state of the part to be absorbed, which renders it unfit to remain under such circumstances; the action excited by this irritation being incompatible with the natural actions and the existence of the parts, whatever these are, therefore become ready for removal, or yield to it with ease. The second is, the absorbents being stimulated to action by such a state of parts, so that both conspire to the same end. When the part to be absorbed is a dead part, as nourishment or extraneous matter of all kinds, then the whole disposition is in the absorbents. (p. 446.) Many parts of our solids are more susceptible of being absorbed, especially by ulceration, than others, even under the same or similar circumstances, while the same part shall vary its susceptibility according to circumstances." (p. 447.)

"Progressive absorption is divisible into two kinds, one without suppuration, and the other with. * * The absorption which does not produce suppuration may take place, either from pressure made by sound parts upon diseased parts, or by diseased upon sound parts." (p. 454.) The absorption attended with suppuration, "which I call *ulceration*," * * * is connected with the formation of pus, being either a consequence of it or producing it, and is that which in all cases constitutes an ulcer. It is this which principally constitutes the progressive absorption. This differs from the foregoing in some circumstances of its operations. It either takes place in consequence of suppuration already begun, and then the pus acts as an extraneous body, capable of producing pressure; or absorption attacks external surfaces from particular irritations or weakness, in which case suppuration, forming an ulcer, must follow, let the cause of that breach or loss of substance be what it may." (p. 456.)

"This process of ulceration or absorption with suppuration, is almost constantly attended by inflammation, but it cannot be called an original inflammation but a consequent, which gave rise to the term 'ulcerative inflammation.' It is always preceded by the adhesive inflammation, and perhaps it is simply this inflammation which attends it." (p. 457.)

"The effect, then, of irritation, as above described, is to produce first the adhesive inflammation in such parts as will readily admit of it, and, if that has not the intended effect, the suppurative takes place, and then the ulceration comes on to lead the matter already formed to the skin if it is confined." (p. 458.) "Any irritation which is so great as to destroy suddenly the natural operations of any one part, and the effect of which is so long continued as to oblige the parts to act for their own relief, produces in some parts, first, the adhesive inflammation; and, if the cause be increased or continue still longer, the suppurative state takes place, and all the other consequences, as ulceration; or, if in the other parts, as secreting surfaces, then the suppurative takes place immediately, and, if too violent, the adhesive will succeed; or, if parts are very much weakened, the ulcerative will immediately succeed the adhesive, and then suppuration will be the consequence. This species of ulceration in general gives considerable pain, which pain is commonly distinguished by the name of soreness; * * * but it does not attend all ulcerations, for there are some of a specific kind, which give little or no pain, such as the scrofula; but, even in this disease, when the ulceration proceeds pretty fast, it gives often considerable pain: therefore the pain may in some degree be proportioned to the quickness of its operation. The greatest pain which in general attends this operation arises from those ulcerations which are formed for the purpose of bringing the matter of an abscess to the skin, as also where ulceration begins upon a surface, or is increasing a sore: whether the increase of pain arises from the ulcerative inflammation singly, or from the adhesive and ulcerative going on together in the same point, is not easily determined; but, in some cases, these three are pretty rapid in their progress, and it is more than probable that the pain arises from all these causes. In those cases where ulceration is employed in separating a dead part, such

as sloughing, exfoliation, &c., it is seldom attended with pain: perhaps it may not be easy to assign a cause for this." (p. 459.)

The following are some of TRAVERS's observations on this important subject:—

"Ulceration, when it occurs, is consecutive to adhesion and suppuration, in almost all cases; and, although suppuration may now and then pass without ulcerations, in the same manner as adhesion prevents suppuration, yet the frequent case of ulcerative inflammation succeeding to abscess, and the very rare existence of ulceration without pus, constitute the ulcerative, third in order, of the processes of inflammation." (p. 187.)

"Ulcerative absorption never occurs but as an inflammatory process, and the action of the absorbents in this process is therefore exclusively a morbid one, and generally partakes of an increase proportionate and corresponding to the opposed action of morbid secretion." (p. 188.)

"The ulcerative, being a purely vital action of the absorbents proper to the part affected, goes on progressively, either by perforation of the substance, or by an encroachment on the surface, or by undermining and separating parts prepared by disorganization or actual death for being cast off. The texture of the part determines which of these modes of action is employed. The cornea, the cartilage, and bone present the penetrating and circumscribed, foveolous or fossulated ulcer, a pit or chink; the cellular membrane presents the hollowing and undermining process, as in the sinuses and pouches of abscess in cellulous parts and on the margin of indolent ulcers, also between the articular extremities of bones and their cartilages; the spreading or superficial ulceration is best exemplified in the skin. But it is always by the absorbents proper to the inflamed surface that this action is carried on." (p. 190.)

"The ulcerative process stands between the life and death of parts subjected to its action, and administers to either, according to the circumstances of the case; being the instrument of reparation in the suppurative and adhesive inflammation, and of separation and removal of the waste and decayed, in the suppurative and gangrenous. It is the agent of granulation in the former, of sloughing in the latter, case, suppuration being the common link by which these extreme processes are connected. Without granulation ulceration is a wasting process; with it, a repairing one. In like manner, ulceration without suppuration is a devastation without means of control or repair." (pp. 191, 2.)

"An ulcer is a patent and familiar illustration of the pathology, not only of the ulcerative, but of all the processes of inflammation; and, as it is that vital action by which not only the dead are separated from the living, but the living are removed, which have undergone such organic changes, or lost so much of their vital power as to be incapable of resisting absorption, it may be regarded, as before observed, as an agent for life and death, and, if in one case the 'natural surgeon,' (HUNTER,) in another the natural destroyer." (p. 196.)]

19. Hardening (*Induratio*, Lat.; *Verhärtung*, Germ.; *Induration*, Fr.) occurs when during inflammation the fluids effused into the cellular tissue (*par.* 4) collect, thicken, and connect the walls of the cells together. Vessels pass into the connecting mass, which becomes organized, and the nutrition of the swelling depends on these vessels. If they are numerous or much expanded, the volume of the part is correspondingly increased, and permanent coagulable lymph is deposited, fatty or even bony masses are produced. If the walls of the cells become firmly united together without further deposit in the swelling, the hardened part sometimes becomes smaller than in the healthy state. The hardness of the indurated part varies according to the quantity of lymph effused in the cellular tissue, according to the structure of the part, according to the course of the previous inflammation, and the duration of the hardening. The skin upon the swelling is commonly not changed: the vessels, however, may be varicose, or the skin itself may be intimately united with the swelling. In this manner are formed, consequent on inflammation, various degenerations, enlargement of parts by hypertrophy, sarcomatous, steatomatous degenerations, and so on.

20. In the hardened parts, if no peculiar irritation exist, the sensibility is

lessened, the circulation seems to proceed but imperfectly, because the nerves are completely enveloped in the plastic mass which connects the several parts, and the more minute vessels are closed: hence the temperature is lower, often sensibly so to the patient himself. Sometimes not the least inconvenience arises from the hardening; but it may run into inflammation, ulceration, and cancer (*a*).

In every part inflammation may run into hardening; but especially in long-continued insidious inflammations; in organs which possess a low degree of vitality, in glands, and those organs in which the very numerous ramifications of vessels are surrounded with dense cellular tissue, in persons of atrabiliary constitution, who have had much mental anxiety, have been subject to scrofula or other diseases which depend upon unnatural mingling of the juices.

21. The transition of Inflammation into *Softening* (*Erweichung*, Germ.) produces changes directly contrary to those caused by hardening, viz., diminished cohesion and consistence—liquescence. It occurs only in long continued dyscratic and cachectic inflammations; it is always connected at the onset with collections of serous, not plastic, matter in the parenchyma of the part, which is therefore sometimes loosened up and thickened; or it consists in actual deliquescence and dissolution of the parts, probably consequent on diminished or changed nervous influence. It may, to a certain extent, be considered as the intermediate condition between ulceration and mortification. The softer and looser the texture of an organ, so much the more readily does softening take place, though it also occurs in hard organs; for example, in the bones: childhood is most subject to it. In many swellings softening precedes and accompanies their giving way.

22. *Mortification* (*Gangræna*, *Sphacelus*, Lat.; *Brand*, Germ.; *Gangrène*, *Sphacèle*, Fr.) is the passage of inflammation into partial death, and the mortified part is subject to the general chemical laws. We usually distinguish with the name of mortification two conditions, viz., the *hot Mortification*, (*Gangræna*, *heissen Brand*, Germ.; *Gangrène chaude* ou *Asphyxie des parties*, Fr.,) in which the living power is not perfectly extinguished, and in which it may be restored to its natural action, (here there is but a certain degree of inflammation,) and the *cold Mortification*, (*Sphacelus*, *kalten Brand*, Germ.; *Gangrène froide*, ou *Sphacèle*, Fr.,) in which the part is actually dead.

[The division here employed by CHELIUS is that proposed by Dr. JOHN THOMSON. TRAVERS objects to the terms mortification and sphacelus on the following ground:—"I do not," says he, "employ the term 'mortification' because it is not technically explicit, and has been vaguely and indiscriminately used. Nor shall I use the term 'sphacelus,' because gangrene is a sufficient synonyme, if the term gangrenous inflammation be accepted, which presents the stages of recoverable and irrecoverable, threatened and devitalized texture. A gangrened part is never restored. By the arrest of gangrenous inflammation, the gangrene may be circumscribed, and, by the supervention of other processes, the dead may be cast off, and the living part repaired with more or less loss of substance. The special use of the term sphacelus has been to designate a state of utter death, in which the part becomes subject to chemical changes, as if severed from the body, and such meaning I affix to the substantive term 'gangrene.'" (p. 208.) Hence it will be observed that TRAVERS's gangrenous inflammation, and his gangrene, are synonymous with CHELIUS's hot mortification, and with his cold mortification.—J. F. S.]

23. Mortification truly consists in the extinction of vascular and nervous activity, in consequence of which partial death ensues. This transition

(*a*) WENZEL, Ueber die Induration und das Geschwür in indurirten Theilen. 8vo. Mainz, 1815.

is to be feared in unusually severe and quickly developed inflammations with well marked general symptoms in young powerful subjects, and after the operation of severe injuries; in persons with the general appearance of weakness, if the redness of the inflamed part be bluish, of a dirty yellow, the pain slight, and if it be accompanied with typhus. If the pain quickly increase to a great degree, the inflammatory swelling be hard, dry, and very tense, the heat intolerable, the skin dark red, often brownish, the fever extraordinarily severe, and no appearances ensue which lead to the hope of the inflammation terminating in suppuration, then the signs of incipient exhaustion become manifest. The acute pain becomes dull, aching, stretching; there is still indeed circulation, but its current gets slower and slower, and at last stops altogether. The redness therefore becomes deeper, more dusky, and further extended; the warmth diminishes, the swelling, at first hard and tense, becomes soft, doughy, œdematous, the cuticle rises in blisters, containing a dark-coloured brownish fluid. In this condition the part has not yet lost all its sensibility and warmth; the vital activity may therefore be reawakened and reparation effected. The pulse is small, quick, and loses all fulness and hardness; the patient is depressed, is uneasy, has a languid countenance, cold sweats, dry, dirty tongue, unquenchable thirst, frequently burning hot skin; the features at the same time become pinched, and the urine is thick. When exhaustion of the living activity and fully developed mortification takes place, then the pain ceases entirely, the colour of the part becomes blue, ash gray, or even black, the bone assumes a light white, dirty yellowish, or even black spotted appearance. By the decomposition of the parts still covered with skin, and the evolution of the gases of mortification an emphysematous swelling is produced, the part becomes quite cold, and the general appearances of exhaustion are present in a higher degree, the mortification either spreads further, and death ensues from exhaustion, or on the confines of the slough is produced a bright redness, suppuration, and by the operation of the absorbing vessels a groove, becoming deeper and deeper, by which the slough is thrown off.

[This is TRAVERS's acute gangrene. He observes also, that "if the inflammation occupies a circumscribed space, it is generally consecutive upon, and defined by, the adhesive inflammation; if it appears in several contiguous spots or patches, the whole of the intervening surface, and more or less of the subjacent and surrounding part, partakes of the inflammation and is marked for destruction; if, as often happens, it is of irregular size and shape and the surrounding margin darkly discoloured, tumid and painful to the touch, it is spreading, and rapidly travels along a continuous surface without check, to the destruction of texture, and generally of life. * * * In some rare instances, gangrenous inflammation takes possession of an entire structure, as, for example, hand or foot, or even a limb up to its connexion with the trunk, and beyond it, and the indication is the sudden subsidence of agonizing pain, change of colour to a pale bluish hue, loss of temperature and of sensation, so that the limb looks and feels like gray or clouded marble. I have seen in two cases the upper and lower extremities of the same side so affected in the same patient. The rapid dissolution of the vital principle in such instances, anticipates the march of disorganization; such cases are generally depending on nervous prostration from injury or operation, attended by peculiar circumstances of aggravation, or, yet more frequently, peculiar temperament." (pp. 209, 10.)]

24. The decomposition of the mortified part is accompanied by a peculiar exhalation, different in smell from that occurring in the decomposition of dead bodies, the cause of which seems to depend on the higher temperature to which the mortified part is exposed. The destruction of the mortified part occurs in different ways: 1st, the slough shrivels up, the

cuticle does not separate, the fetid exhalation is less, the pain is sometimes very severe (*Dry Gangrene; Trockner Brand*, Germ.; *Gangrène sèche*, Fr.;) 2nd, the mortified part increases in bulk, the cuticle rises in blisters, which burst and discharge a quantity of stinking ichorous fluid (*Moist Gangrene; Feuchter Brand*, Germ.; *Gangrène humide*, Fr.;) 3rd, all the organic structures without distinction are changed into a glutinous grayish white or ulcerous mass (*Hospital Gangrene; Hospital-brand*, Germ.; *Pourriture d'hôpital*, Fr.)

[In severe bruises, and occasionally when, after the swelling of a limb consequent on a fracture, the bandages confining splints have become tight and caused much pressure, vesications filled with bluish or bluish-black fluid occur. This often excites alarm, and is mistaken for mortification; but it is of little consequence. It is only requisite to puncture the blisters with a needle, evacuate the fluid, and apply lead wash for a few days, when all soon becomes sound. If the vesications are left unemptied, they often produce inconvenient superficial sores, which heal with the use of zinc ointment.—J. F. S.]

25. Mortification may be produced by all hurts which cause a too high degree of inflammation, obstruction of the circulation, weakness, oppression of the nervous activity, and thereby loss of life of a part; for instance, too irritating treatment of inflammation, checking of the circulation by ligature, too tight bandaging, pressure kept up by unyielding aponeuroses; violent operation of heat and cold, malignant character of the inflammation where in seeming mildness of the symptoms mortification often occurs, of which the cause is generally unknown, but sometimes depends on hurtful matter in the bowels; further, from a great degree of weakness, degeneration of the juices, scurvy, and so on, malignant, putrid fevers, great age, severe bruises and concussions, by which the part is filled with stagnant juices; ligature and ossification of the vessels, (which may without inflammation give rise to mortification,) certain fluids extravasated from their cavities, as urine, bile, feculent matter; bad foul air and contagious influences.

[Brodie (*a*) enumerates sudden loss of blood as sometimes causing mortification, and in proof mentions the case of a man who, whilst very tipsy, one evening, was bled to the extent of three pints, when he became very ill, and the next morning his toes and feet up to the insteps were mortified. They sloughed off, however, and he did well. (p. 635.)

Travers mentions among the causes of mortification "such deep and extensive effusions as compress and annihilate the internal circulation of the part. Thus, I have seen," says he, "a subfascial effusion, following a severe strain of the fore arm, producing a spreading gangrenous inflammation of the extremity to within a hand's breadth of the axilla; and similar cases, of suppuration, between the deep-seated muscles of the thigh, I have known terminate suddenly in gangrenous inflammation of the entire limb to the groin. Injuries of nerves, particularly, are liable to be followed by gangrenous inflammation: of this I have also seen some marked examples. Baron Larrey found reason to attribute the gangrene of the foot following the operation for popliteal aneurism to the nerve having been injured or included in the ligature." (p. 214.)

I recollect many years ago seeing a case of mortification of the whole lower extremity, consequent on a bayonet wound of the femoral artery, in which the death of the limb seemed to result from the slow effusion of blood and gradual distension first of the fasciæ, and subsequently of the skin, which occupied many months. The man was a sailor, and during a homeward voyage from the East Indies dropped a bayonet point into his thigh. The ship being without any surgeon, the captain bandaged the thigh tightly up, and effectually prevented external hæmorrhage for five or six weeks. When he reached home, he was brought to St. Thomas's Hospital, and, on removing the bandage, the wound was found united. The limb was much swollen up to the pelvis;

(*a*) Lectures on Mortification; in London Medical Gazette, 1840–41, vol. i.

but his health had not suffered much. It was thought advisable to wait and see what might be the result. The limb increased in size, the skin gradually became more and more discoloured, and gangrenous in patches; indistinct fluctuation was perceived: he was slowly worn out, and died. On examination, the whole limb was found distended with blood, some of which was coagulated, some fluid, and other mixed with pus. On removing the clots, which were principally about the femoral artery, a spurious aneurism was found, the sac formed by the clot being as large as a hen's egg around the wound made by the bayonet in the artery, which had not closed, and was rather bigger than a crow-quill. On one side of the sac, close to the vessel, was a small aperture, by which blood had continued escaping, probably up to his death, into the surrounding soft parts.

Mortification of a limb, or at least of that part of it in the neighbourhood of an aneurismal sac (which is not uncommon if from any cause the vessel have not been tied at the proper time) in general depends simply on the distension from effusion, which at last bursts the skin.

Mortification occasionally happens in simple fracture, from slow but continued effusion, and without wound of the principal artery or arteries of the limb. I have seen this once in a flour-porter, whose leg was broken by being jammed with a cart-wheel; his constitution speedily took the alarm, and, though incisions were made through the skin to relieve the tension, he gradually became worse, and sunk into hectic, in which state his limb was removed; but he died a few hours after. Although from the first no pulsation could be felt in the tibial arteries, yet the examination after death showed them uninjured and undiminished in size.

Mortification I have also seen in one or two instances occurring from splints having been applied previous to the subsidence of the swelling after fracture, and not proportionally loosened as the swelling increased.

The two following are cases of mortification, resulting, the first from simple continued fever, and the second probably after scarlet fever:—

Case 1.—J. J., forty-eight years of age, a hatter by occupation, of intemperate habits, is now—

Aug. 1. Slowly recovering from an attack of fever which commenced seven weeks since. A sore on the inner ankle of the left leg, which he has had for eighteen months, about five weeks since became sloughy, and the surrounding skin was attacked with gangrene, which continued spreading till it has attained its present size, that of the hand. As yet there is not any line of demarcation, and the wound is very painful though cleaning. He is much emaciated, very weak, without appetite, cannot rest, his pulse extremely quick and almost imperceptible, (this may perhaps arise from exhaustion in bringing him to the hospital,) the countenance sunk and pallid, surface warm, but occasionally bathed in profuse sweats, tongue clean. I ordered for him five grains of carbonate of ammonia, with ten minims of tincture of hyoscyamus every six hours, six ounces of brandy and a pint of beef tea, with arrow-root daily. To the wound, chlorate of soda lotion and linseed-meal poultice.

Aug. 2. Better, but without sleep. Twenty minims of tincture of opium at night.

Aug. 4. Is improving; the wound is free from pain, and two or three granulations are seen in its centre; the slough has rather increased. An abscess which has formed on the outside of the knee was opened, and a teaspoonful of thin but otherwise healthy pus discharged; pulse improved; he complains of sore throat, with difficulty in swallowing, and disposition to retch, but he takes plenty of fluid though he cannot manage solid food. As he wished for some porter, a pint daily was ordered. The mixture discontinued; but twenty minims of tincture of opium in camphor mixture directed to be taken at night.

Aug. 9. Is improving, and yesterday began taking a mutton chop. The slough has cleaned from the wound, leaving a sore surface which, occupying nearly two-thirds of the back and inner part of the leg, is now beginning to granulate. As the pus seemed disposed to bag on the outside of the instep, in consequence of the limb lying on its outside, the skin was cut through to prevent this, and a small abscess below the tubercle of the shin-bone opened.

Aug. 15. Improving, and desiring more nourishment. Two pints of beef tea daily.

Aug. 22. The wound almost completely cleaned, but the granulations are flabby and pale. An abscess which has formed at the upper part of the thigh was opened, and about an ounce of good pus evacuated. He wishes to have more porter, which was therefore increased to two pints, and the brandy diminished to four ounces. Nitric acid wash to be applied to the wound.

Sept. 2. During the last two or three days the granulations have been receding,

and have now exposed a large portion of the shin-bone, which is apparently dead; a considerable part of the Achilles' tendon has become gangrenous. The drain upon his constitution has lately been much increased, and it is now a question whether amputation be not necessary, and also whether he is in a condition to bear it.

Sept. 6. The wound is more healthy, and the gangrene seems to have stopped. Another abscess, merely superficial, which had formed about the middle of the thigh, burst yesterday.

Sept. 11. Sleeps well and feeds well, but does not get flesh; there has been a slight increase of sloughing on the instep, but it is now cleaning. The discharge from all the wounds is very free, and the granulations rather more florid.

Sept. 13. Appetite failing. An abscess on the inside of the calf, which seems to extend among the muscles, opened, and about three ounces of pus discharged.

Sept. 20. Still declining, and during the last two or three days sloughing has recurred. Amputation was therefore proposed, but he would not consent.

Sept. 24, 9 A.M. Much exhausted; pulse quick and scarcely perceptible; countenance pallid; voice weak; the sore quite bleached. I ordered him brandy and egg, as much as he could be induced to take, which somewhat revived him, and afterwards he took some wine. At 1 A.M. bleeding occurred, probably from the saphenous vein, as it traversed the wound; it was, however, easily checked, and did not recur. He continued gradually sinking, and, on

Sept. 25, 2 P.M. He died.

CASE 2.—E. U., twenty-seven months old, of scrofulous habit, has been weaned about thirteen months, and, like the children of the poor generally, since fed on bread and butter, with tea. She has been always healthy till about sixteen days since, when the whole surface of the body became so scarlet that it was supposed to have scarlet fever. Two days after she was observed to point continually to the left side of her chest, and on examination there was found on the axillary margin of the pectoral muscle a dark-coloured swelling, in circumference about the size of a small tea-cup. Soon after the redness of the body subsided; but her belly was enlarged and the legs swollen. It would, therefore, seem probable that the previous disease was scarlet fever.

At the present time (*Sept.* 8) there is a well-formed brown slough, surrounded with a dusky-red elevated edge of skin with similar inflammation extending about half-way down the left arm, also upon the neck and back, reaching as far as the right shoulder. The cellular tissue of the right arm-pit hard, inelastic, and painful, as if another slough were likely to take place. A layer of the slough was removed, and strong nitric acid applied with a feather; after which it was covered with nitric acid lotion and linseed-meal poultice. To the back of the neck a linseed poultice with acetate of lead wash was applied. Five grains of extract of bark every four hours, and an ounce of gin every six hours, were given in arrow-root.

Sept. 10. The sloughy sore is cleaning; but the hardness on the right shoulder has increased; the inflammatory blush has spread considerably, and now covers all the chest and the belly as far as the navel, extending down on either side towards the flanks. On the left arm it reaches below the elbow, and on the right half down the upper arm. The cellular tissue on the loins is œdematous. As the gin is rejected, a couple of teaspoonfuls of port wine with syrup was ordered frequently during the day, but not to exceed four ounces. Two grains of mercury with chalk, and four grains of rhubarb with as much carbonate of soda, nightly, were prescribed.

Sept. 11. Has had three dark-coloured stools, but her appearance not improved. She continued sinking, and about 4 P.M. died.

No opportunity of examining her body occurred.—J. F. S.]

26. The mortification dependent on very low vital activity which generally attacks the feet and more rarely the hands of old people (*Senile Gangrene*, *Gangræna senilis*, Lat.) must be considered as peculiar. Under this name, however, conditions have been classed together which, at least in reference to their origin, must be distinguished from each other.

27. In persons who in every respect have lived irregularly, and whose living powers are in a great degree exhausted, who have suffered much trouble, and had irregular gout, specially in the feet, an erysipelatous inflammation with dusky redness and severe pain arises after any injury,

viz., after the violent action of frost, contusion or wound of the toes in cutting the nails or corns. This redness spreads more or less, forms blackish bladders on one or more toes; the cuticle separates, and the exposed true skin exhibits a deep dusky redness. The inflammation usually spreads still further, but slowly; attacks one after another all the toes; and usually in its progress the part next to be attacked swells, and is excoriated. Sometimes it is circumscribed, in which case the toes dry like mummies and fall off. Most commonly the mortification spreads over the ankle-joint, and in its further extension death ensues from exhaustion: it may, however, be confined to different parts, and nature may bring about a separation of the mortified part. The pain is usually severe, and is soon accompanied with fever.

28. In this kind of mortification the depressed condition of the vascular and nervous activity must be considered as the actual cause why in the operation of the above-mentioned hurts, the inflammation quickly passes into mortification and drying up, mostly of the parts farthest distant from the centre of circulation. This mortification exhibits some similarity to the dry mortification of frostbite.

29. The other form of this mortification happens without any previous local injury, but after general indisposition of more or less duration, such as depression of spirits, listlessness, unquiet sleep, debility, sparing, high-coloured urine, laborious breathing, palpitations of the heart, anxiety, pain at the pit of the stomach, small, weak, irregular, or intermitting pulse, shiverings, or constant internal cold. In the part in which subsequently the gangrenous drying appears, pains of varying severity come on, sometimes accompanied with cramps in the extremities: these go on for weeks, and even for many months, before the local destruction is observed. Or the patient has a sensation of cold in his extremities, a recurring sensation of being asleep for a longer or shorter time, insensibility to external irritation of the fingers and toes, entire loss of motion. Without any local cause the patient observes on his toe or on his finger a black, blackish-brown or brownish (never dusky-red according to BALLING) colour, without any tense swelling. The part dries, the cuticle loosens itself, the part becomes quite black and lifeless. The prognosis of the disease varies: often is only one toe or one joint thrown off, or it attacks all the toes, confines itself to the foot, or spreads up to the knee. The process of separation is connected, as in common mortification, with a bounding red line and slight suppuration. This kind of mortification may occur on various parts at the same time. The same appearances take place in children: the extremity becomes black-blue, its temperature diminishes, and it seems to be completely atrophied. In one case BALLING observed a blackish-yellow colour and dried skin. Sometimes a lower degree occurs, and then from the first the extremities are livid and œdematous.

[This form of mortification is TRAVERS's chronic gangrene, which he says "is generally an idiopathic affection, *i. e.* independent of injury, and which he has never known to be traumatic. * * * The main distinction between this and acute gangrene is, that from the first the part thus affected losing its temperature and colour becomes dry, tough, and shrunken, instead of moist, soft, and swollen, and takes on a yellow or blackish-brown appearance, nearly resembling that of a mummy." (p. 211.)]

30. This form of mortification or mummy-like drying up is always the consequence of an exhaustion in the peripheral parts of the vascular and nervous systems. This condition occurs most commonly in old, decrepid

persons living anxiously and in want of food; more frequently in men than in women; in persons who have prematurely exhausted themselves by excessive debauchery; in those subject to the gout, in whom, perhaps, the ossification of the arteries, so often observed in this kind of mortification, seems to be connected: this disease, however, may occur in every age if the above conditions are present. This kind of mortification may arise suddenly, and without any previous inflammatory symptoms, by metastasis during the course of malignant fever (1). In children born with blue, cold atrophied extremities, in whom the circulation does not proceed properly it is often noticed. The closing up of the blood vessels is, according to BALLING (*a*), constantly observed (2). Organic changes in the heart and aorta are also invariably present (3).

(1) I have seen one case in a man thirty-five years old, in whom during the progress of abdominal typhus, the right foot up to the middle of the leg, became suddenly pale, icy cold, senseless and motionless, shrivelled, subsequently quite black, and the dry gangrene reached to the upper third of the leg, where it stopped.

(2) The closing up of the arteries *is always present in dry gangrene*, as was observed in former times; it may be also in certain cases the special cause of the mortification, and consequence of the inflammation of the arteries, (*arteritis*,) or of the capillary vessels, first described by DUPUYTREN (*b*). It cannot, however, be considered as the general and constant cause; for, in many cases, there is not a single previous appearance indicating inflammation of the arteries, and their closure is caused by the mortification, and consequent to it. Compare also HECKER (*c*).

(3) I have observed a case of dry gangrene in a man about forty years old, which extended up to the middle of the leg, where it stopped, and the part separated. There had existed for a long time undoubted symptoms of organic disease of the heart.

[BRODIE (*d*) mentions a case of mortification of the leg up to the middle of the thigh, which commenced with a sense of pricking numbness and weight, and on the following day the limb had mortified; "no vesications formed on the foot; it was not swollen, and no part became putrid except just a little in the middle of the thigh, where was a great mass of soft parts. The limb dried, the skin assuming a brownish colour, being at the same time hard and semi-transparent, so that the white tendons could be seen shining through it. It was in fact what has been called a case of dry gangrene." The patient's powers failed, and he died at the end of six weeks. Upon examination, BRODIE "found marks of inflammation everywhere around the principal artery and vein of the limb. From the bifurcation of the large trunk down to the middle of the thigh, the artery was obliterated, being completely filled with coagulated lymph, evidently effused from inflammation; closely adhering to the inner surface, but with some admixture of red coagulum. The vein was filled with lymph and obliterated in the same manner as the artery. There had been inflammation of the sheath of the vessels, in consequence of which the artery and the vein adhered closely to each other and to the surrounding parts. I suppose that the nature of the case is plain enough: there had been inflammation of the artery and the vein, and the obliteration of the artery was to so great an extent as to cut off the supply of blood, not only through the trunk, but through the anastomosing branches." (p. 635.) BRODIE also points out the cause of the distinction between dry and moist gangrene:—"If mortification be the result of inflammation or of venous obstruction, there is always an effusion of serum before the parts completely dry, in the form of vesication of the skin and œdema of the cellular membrane; and then, when the parts die, being infiltrated with serum, they readily become putrid. But here (in inflammation of the arteries) the blood is prevented from entering the limb, so that there can be neither vesication nor effusion of serum into the cellular membrane, and the dead parts dry readily from the absence of moisture." * * * Gangrene from arterial inflammation is comparatively a rare disease, and may occur at any period of life; whereas the gangrene of old age arises, as repeated dissections have enabled me to determine, entirely from other causes." (p. 636.) From this latter observation it will be perceived that BRODIE does not agree either with CRUVELHIER (*e*), who

(*a*) Ueber die *Gangræna senilis* in Journal von v. GRAEFE und v. WALTHER, vol. xiv. p. 42.

(*b*) Transactions Médicales, May, 1833.

(*c*) Nosologisch-therapeutische Untersuchungen über die brandige Zerstorung durch Behinderung der Circulation des Blutes. Stuttg., 1841.

(*d*) As above.

(*e*) Maladies des Artères; in Dictionnaire de Médecine et de Chirurgie Pratiques, vol. iii. p. 394.

says, that "coagulation of the blood is, after his observations, the essential character of incipient *arteritis*," (p. 394;) or with DUPUYTREN (*a*), who says that, in such cases, "Pathological anatomy always shows the existence of inflammation of the arterial tunics. This phlogosis may doubtless occur in arteries which are unhealthy, indurated, ossified, as often met with in old persons; but it appears also in the arteries of young people without trace of these disorders. In a word, it may coincide with the calcareous incrustation of the vessels and with age, or it may be independent of both conditions." (p. 484.)

I have seen but a single case of *arteritis*, which happened in a young man of twenty years. It differed from BRODIE's case in not having exhibited the slightest appearance of gangrene, and, on dissection, the brachial artery was found partially obliterated, and shrivelled to a narrow cord, precisely as if a ligature had been applied upon the subclavian artery. Although, in this case, the pulse at the wrist ceased suddenly, yet the circulation was undoubtedly carried on by the collateral circulation, and thus gangrene prevented. I shall refer to this case again when considering inflammation of the coats of arteries. (p. 74.)—J. F. S.

A most remarkable case is given by SOLLY (*b*) of gangrene, which commenced in a boy about three years old, and, gradually spreading from limb to limb, destroyed him when four years old. In four months from its commencement the disease had amputated the left foot above the ankle, as also two toes of the right foot, and upon the right calf and knee were hard gangrenous spots. The right fore arm was cut off through the middle of the ulna, and the radius had dislocated itself from the elbow joint; the whole of the left fore arm and part of the upper arm were gangrenous. There was a dusky spot on the nose upon the scar left by a gangrenous spot which had formed previously, and separated. In the sixth month the left leg, which had become quite gangrenous, was thrown off below the knee, and the toes of the right foot had also sloughed off. The right ulna had come off at the elbow-joint, and the left arm had amputated itself through the middle of the upper arm. The gangrene on the nose had reappeared, but been checked. For a short time there seemed a little rest in the gangrenous process; but it was again set up, and by the twelfth month the left leg had become gangrenous to the middle of the thigh, and all the soft parts separated, leaving the bone bare. The right leg had mortified to the middle of the calf, and the right foot separated above the ankle. The stumps of both arms had become gangrenous up to the shoulders. In the beginning of the following month the child died. Careful examination of the body did not show any organic disease; but the child had become much emaciated. The stumps of the arms had nearly healed; but in the lower limbs the bones protruded, and the cure was less perfect.]

31. Mortification from continued pressure, or from constant lying upon one part (*gangræna ex decubitu*) occurs more readily, the weaker the patient, and the less cleanly and smooth the bed is. On those places where the pressure acts, most commonly, therefore, on the sacrum and coccyx, the great trochanters, the shoulder-blades, elbows, heels, and so on, a limited redness appears, with pain more or less severe, the skin is destroyed by ulcerative absorption, and a dry slough is formed, which is dissolved in the suppuration set up around it. Should the pressure continue, and the general weakness be great, (for example, in typhus fever,) the destruction spreads very extensively, and in many cases death is thereby accelerated or even caused.

32. A special mention is required of that mortification which, in certain localities, in very wet and humid years, when the rye is infected with the blight, called "cockspur," occurs in the lower extremities, with a constant sensation of itching, great burning, and a darting pain, sometimes with redness and swelling, consequent on which the parts become cold, senseless, black, mummy-like, and shrivelled up. In rare cases this disease has been also observed in the upper extremities. During the course of the disease general symptoms, fever, delirium, and so on frequently arise. Oftentimes the mortification becomes defined and the part is thrown off, and often it spreads up to the hip-joint.

(*a*) Leçons Orales de Clinique Chirurgicale, vol. iv.

(*b*) Med.-Chir. Trans., vol. xxii. p. 253, 1839; vol. xxiii. p. 237, 1840.

[A very interesting account of mortification from the use of rye-bread affected with cockspur (*secale cornutum*, Lat.; *Mutterkorn*, Germ.; *ergot*, Fr.) has been given by THOMSON. "This is," says he, "a species of mortification which has not been observed in this country; but it is well known and has been frequently observed in different parts of the continent of Europe, particularly in France, where it has been repeatedly known to prevail in some districts as an endemial disease." (p. 538.) PEREIRA (*a*) supposes this disease is referred to in a passage he quotes from SIGEBERT. "1089, a pestilent year, especially in the western parts of Lorraine, where many persons became putrid, in consequence of their inward parts being consumed by St. Anthony's fire. Their limbs were rotten and became black coal. They either perished miserably or, deprived of their hands and feet, were reserved for a more miserable life." He also refers to a similar passage in BAYLE, with the addition, that "the bread which was eaten at this period was remarkable for its deep violet colour." (part ii. p. 595.) THOMSON says, the disease was first noticed by DODARD in 1676; then by SAVIARD (*b*), in 1694; and by NOEL (*c*), in 1710, in the Hôtel Dieu at Orleans, of which they were both surgeons; in 1709 and 1716 it appeared in Switzerland, and was described by LANGIUS (*d*); QUASSOUD, and also BOSSAU, described it on its appearance in Dauphiny in 1709. DUHAMEL (*e*) mentions that in 1748 not more than four or five persons out of a hundred and twenty who had been attacked escaped with life. ELLIOTSON some years since had, in St. Thomas's Hospital, a case of gangrene of the leg after using ergot; but he informs me that on examination after death the arteries of the limb were found ossified: it might, however, have been the immediate exciting cause of the disease.

Although there was no doubt that in man the cockspur would produce gangrene, MODEL (*f*), a Russian, made experiments which led him to conclude that rye, damaged with cockspur, had not the power of exciting gangrene in brutes. This remarkable statement induced the Royal Society of Medicine at Paris to employ TESSIER (*g*) to visit those countries where the disease was prevalent, and to institute experiments to determine the fact, and the result showed that brutes eating it were destroyed by gangrene; but, in all the animals upon which it was tried a certain quantity, varying according to circumstances, of the cockspur was required to be taken, in order to produce the effect; and, as THOMSON says, "this afforded also a simple explanation of the fact, that persons might live for a considerable time upon rye affected with cockspur without suffering any sensible injury from its use." (p. 547.) PEREIRA states, however, that "there are not wanting cases apparently showing that spurred rye has no injurious action on animals. The most remarkable and striking are those related by BLOCK. In 1811 twenty sheep ate together nine pounds of it daily for four weeks without any ill effects. In another instance twenty sheep consumed thirteen pounds and a half daily for two months without injury. Thirty cows took together twenty-seven pounds daily for three months with impunity, and two fat cows took, in addition, nine pounds of ergot daily, with no other obvious effect than that their milk gave a bad caseous cream, which did not yield good butter. These statements furnish another proof to the toxicologist that the ruminants suffer less from vegetable poisons than other mammals." (p. 600.)

A very curious history of a mother and five children, some of whom lost one and others both legs, as related by Dr. C. WOOLASTON (*h*), seems to have originated in the use of discoloured clog-wheat.

Ergotism, as the disease produced by the cockspurred wheat or rye is called by the French, is of two kinds, the *convulsive* and the *gangrenous*; with the latter only have we to do here; it sets in with formication, or the feeling of insects creeping over the skin, voracious appetite, coldness and insensibility of the extremities, followed with gangrene.]

[32.* Here must also be mentioned that mortification of the cheek which has been called *Noma* by VOGEL. It is fortunately not frequent, as it is a horrible and generally fatal disease. With a single exception, of the half dozen cases I have seen, all were children under four or three years old; some idiopathic, and others originating in a sloughing of the mucous membrane of the mouth, under the careless use of mercurials; and, though

(*a*) Elements of Materia Medica, part ii. London, 1840. 8vo.
(*b*) Journal des Savans, 1676, p. 76.
(*c*) Mémoires de l'Académie Royale des Sciences de Paris, 1710, p. 61.
(*d*) Descriptio Morborum ex esu Clavorum Secalinorum.
(*e*) Mémoires de l'Académie Royale de Paris, 1748, p. 528.
(*f*) BOMARE, Dictionnaire d'Histoire Naturelle, vol. xix.
(*g*) Mémoires de la Société Royale de Médecine, 1776, p. 254, 1777-8, p. 587
(*h*) Philos. Trans., 1762, p. 523.

generally in unhealthy subjects, yet the disease also occurred in robust, well-fed children. In its idiopathic form it has been well described, by Drs. EVANSON and MAUNSELL (*a*), as follows:—"A particular form of gangrene of the mouth, without any preceding inflammation, occasionally attacks infants, especially such as are feeble at birth or broken down by disease. An œdematous circumscribed swelling appears on the cheek, with a central point, more or less hard, over which occurs a dark-red spot. This spot may appear on the inside or outside of the cheek; and the skin over the œdematous part is characterized by an oily appearance. An eschar forms from within outwards on the central point, and the soft parts mortify, often extensively, down to the bone, so that the parietes of the cheeks and gums are destroyed, falling off in shreds, mixed with a dark sanguineous fluid, and accompanied by a very fetid odour." (p. 214.) In neither of my cases, excepting the adult, did I witness the beginning of the disease; but gangrene to a greater or less extent of one cheek, involving generally the corresponding half of the upper lip, existed when the children were brought to me; the surrounding parts were tumid, hard, and of dull yellow-white hue, very similar to the characteristic colour of the countenance of patients under malignant disease. I have little doubt that the mortification of the mouth and fauces after measles, mentioned by HUXHAM (*b*), as well as those referred to by MARSHALL HALL (*c*), and by him stated to have happened after previous disorder of the digestive organs, typhus fever, or some inflammatory disease, are of precisely the same character as those resulting from mercurial influence. The little patient, if not already in a typhoid state, soon falls into it, rapidly sinks as the gangrene spreads, and quickly dies; often, indeed, before the least attempt at separation of the slough has been made. Usually three or four days are sufficient to destroy life; but, in one instance, I recollect a child of two years old having lived for a fortnight, and the greater part of the gangrenous cheek had separated, leaving one side of the cavity of the mouth completely exposed. I fully agree with EVANSON and MAUNSELL, that "no disease can be more frightful or formidable than sloughing of the mouth in children. Recovery seems impossible, when once the disease has set severely in, the child sinking beneath the constitutional disturbance, independent of the local ravages of the disorder, which, however, are often such as to render recovery not to be desired, so frightful is the deformity necessarily entailed." (p. 215.)

The term *Cancrum oris* has been loosely applied both to the disease just mentioned, and also to another form of mortification commencing with ulceration, generally first in the gums, and thence spreading to the lips and cheeks. This second form alone is considered by Dr. CUMMING (*d*) to be *cancrum*. He describes it as being either acute or chronic, and, if the former, more liable to be accompanied with sloughing, but the ulcerative process predominates, and by it, principally, the destruction is effected. It does not, according to this writer, attack children at the breast, nor under eighteen months, but occurs between twenty months and seven years.

The following is a short account of the case of noma in the adult alluded to above:—

R. I., a gunmaker by trade, was admitted under my care—

(*a*) A Practical Treatise on the Management and Diseases of Children. 2nd Edit. Dublin, 1838. 8vo.

(*b*) Reports, July, 1745.

(*c*) On a peculiar species of Gangrenous Ulcer which affects the Face in Children; in Edinburgh Medical and Surgical Journal, vol. xv. p. 547.

(*d*) Dublin Hospital Reports, vol. iv. p. 18.

August 1, 1844. Having two superficial sores on the glans penis and a superficial sore on the back of the pharynx, sloughy and painful, so much so as to prevent him sleeping at night. He is much out of health; quick, irritable pulse; hot, dry skin and foul tongue. He has also a very small sore, scarcely perceptible, and covered with a dry scab, on the face near the nostril. He was not seen till

August 2. Probably from not having come in, and then ordered *pulv. rhei c. hydr.* ℈j. *stat; sod. carb. gr.* xv. *acid. citr. gr.* x. *tinct. hyoscyam.* ℥ss. *aq. distill.* ℥jss. 6*tis horis; garg. acid. nitr.*

August 6. The mixture omitted, and in its stead ordered *acid. nitr.* ♏ iij. *inf. rosar.* ℥jss. *ter die. pulv. ipec. c. gr.* x. On

August 9. Very restless, scarcely sleeps at all; and is so feeble that he can hardly answer the questions put to him. Ordered a glass of wine and a pint of porter daily, and *morph. mur. gr.* ⅛. On

August 15. Has slept better since taking the morphia. The crust under the right nostril has increased in size and is accompanied with swelling of the surrounding parts, which are of a purplish colour.

August 17. Is much worse; the lip immensely swollen and livid, but not giving any discharge; face so much disfigured that he can scarcely be recognised. The sore in the throat much worse; bowels confined. ℞ *pulv. rhei. c. hydr. gr.* xv. *stat; vin. rubr.* ℥vj. *quotid.*

August 20. Is very feeble and unable to speak. The slough has now extended around the mouth from the nose to the chin, including the lips and part of both cheeks. The sore in the throat has become very sloughy. Four ounces of brandy, three eggs and some arrow-root were ordered; but he was not able to take much, and gradually sunk till

11. *p. m.* When he died. No discharge at all had occurred from the lip. No examination of the body was made.—J. F. S.]

33. Mortification occurs as a consequence of contagious influence, either by the contagious matter producing at first an inflammation which terminates in mortification, (*malignant pustule,*) or by coming in contact with the surface of a wound or sore, whereby the destruction of it is brought about (*hospital gangrene.*)

34. The *Malignant Pustule* (*Pustula maligna,* Lat.; *bösartige Pustel,* Germ.; *Pustule maligne,* Fr.) is always consequent on local contagion. On the place which the contagious matter has touched, there appears in a short time prickling and a red point, which is scarcely raised above the skin. The cuticle rises in a blackish vesicle, which is soon converted into a slough surrounded by a whitish or violet edge and œdematous swelling, and spreads quickly in all directions. From the very onset there is perceived in the pustule a hard nucleus, which enlarges both inwards and outwards, or only spreads laterally. Notwithstanding the decided swelling, the patient complains rather of tension than of actual pain. Sooner or later it is accompanied with fever, pain in the region of the stomach, nausea, vomiting, high delirium, fainting, and so on. The pulse is small, irregular, and, if left to itself, the disease generally runs on to death, which in malignant cases follows very speedily. It is rarely that the slough comes away, and that the cure is effected by the mere powers of nature, or that in the course of this disease the general symptoms already mentioned do not appear. If several pustules are formed at the same time, especially on the neck or face, the disease is more dangerous. The swelling is often here so great that symptoms of suffocation and congestion of the brain are produced. In women the disease proceeds more quickly than in men. At the onset a stop may usually be put to this disease; the danger increases in its subsequent course. It differs from carbuncle (*par.* 118.)

The contagion develops itself in beasts which are affected with conta-

gious carbuncle (*Milzbrand*;) it may be communicated whilst the animal is alive, or it may take place during the preparation of wool, hides, and so on. The malignant pustule is therefore most commonly observed in butchers, tanners, woolbeaters, shepherds, and especially on those parts of the body usually uncovered. In wet districts, in moist autumns, the disease is most common. The contagion preserves its power for a long period. Actual contact is not always necessary to produce infection. The use of the flesh of such beasts sometimes does not produce any, but at other times very dangerous, symptoms. This disease seems not to be communicable from one man to another, at least the facts relating thereto are not perfectly indisputable; it is also doubtful whether the general symptoms can be produced by the assumption of this contagion into the body, without the malignant pustule on the skin.

Precisely similar phenomena have been observed in reference to the transference of the poison of glanders from horses; upon which see the article entitled

Ansteckung, Uebertragung des Ansteckungstoffes von Thieren auf Menschen, in Hufeland's Journal, vol. iv. part iii. p. 57, which contains the following three notices:—

Remer, W., Ein Beitrag zu den bisherigen Beobaetungen von Krankheiten der Thiere, welche sich dem Menschen mitgetheilt haben.

Schilling, Merkwürdige Krankheits-und sections-Geschichte einer wahrscheinlich durch Uebertragung eines thierischen Giftes erzeugten schwarzen Blatter. (This notice is also in Rust's Magazin, vol. ii. p. 480.)

Meier, Tödtliche Uebertragung des Milzbrandes auf Menschen.

See also,

Tarozzi, Tommaso, Casi di Malattia Pestiforme nata in diverse persone che convenivano in una stalla in cui era un cavallo moccioso; in Omodei's Annali Universali di Medicina, 1822, vol. xxiii. p. 220.

Seidler, Geschichte einer muthmasslich durch Uebertragung eines thierischen Kranhheitsstoffes erzeugten merkwürdigen, in tödtlichen Brand ubergegangenen Gesichtrose, in Rust's Magazin, vol. xvii. p. 161.

Eck, Beitrag zu den Erfahrungen über die schädlichen Einwirkungen des Rotzgiftes des Pferde; in Medinischer Vereinszeitung für Preussen. 1837. 3rd May.

Elliotson, John, M.D., On the Glanders in the Human Subject, in Med.-Chir. Trans., vol. xvi. p. 171. Additional Facts respecting Glanders in the Human Subject, ib., vol. xviii. p. 201.

[Elliotson has given a very excellent account of "The Glanders in the Human Subject," in which the communication of the disease from the horse to the patient is distinctly made out. He mentions six cases; the first three he considers *acute*, two of which occurred in St. Thomas's Hospital, and both died very speedily after having been attacked; the third occurred in a dragoon regiment in Ireland; the fourth was a veterinary surgeon at Clapham; both died. Two cases, which he calls *chronic*, extracted from Travers's book "On Constitutional Irritation," one of which died, and the other long suffered from a broken-up constitution. He also refers to the cases mentioned in Rust and Omodei's journals. In a subsequent paper he gives "Additional Facts respecting Glanders in the Human Subject," in which he mentions another case that occurred in St. Thomas's Hospital, which also died.

I have to thank my friend Lawrence for the following observations of the cases of malignant pustule which have come under his care, and which, on account of their rarity I gladly avail myself of the opportunity to introduce on the present occasions. He says:—

"I have had under my care, in St. Bartholomew's Hospital, three cases of malignant pustule, in neither of which, however, did I see *either pustule or vesicle*; of the first and most remarkable, the following is the report from the Lancet of 1825-6, p. 127, in

which it is described as "*A singular case of Erysipelatous Inflammation of the lower Eyelid, terminating in gangrene in the short space of six hours.*"

John Barker, aged 52 years, currier, stout and robust, came to the Ophthalmic Institution, and, immediately after, in consequence of the nature of his ailment, by Mr. LAWRENCE's advice, was sent into St. Bartholomew's Hospital.

Feb. 18, 1826. He stated, that the day before yesterday, whilst at his usual employment, he struck his right eye with a skin of leather, which at the time caused him great pain and uneasiness. At this time there is an erysipelatous inflammation extending around the organ, but more especially on the lower lid and adjacent portion of the cheek, in the centre of which there is a hard and indurated lump, more prominent than the rest, feeling like carbuncle. It has a very livid hue, and may be said to have gone into a state of gangrene. Since his admission into the hospital, he has not complained of any particular pain in the part, nor is the constitution apparently much affected; the tongue is but slightly loaded; the pulse feeble. Mr. LAWRENCE made an incision through this hard and indurated portion, when a little dark blood escaped. The globe of the eye not in the least affected. Two grains of sulphate of quinine to be taken every six hours, and six ounces of port wine, daily.

Feb. 22. The pulse having been quickened last night, the wine has been in consequence discontinued; and a dose of house medicine given this morning.

The tumefaction above the lid still continues, and there is now a distinct line of demarcation around the gangrenous spot before alluded to. The whole of the inflamed skin, has a peculiar, hard, brawny feel, very similar to carbuncular inflammation. Mr. LAWRENCE stated, that when the man came to the infirmary, there was no unusual vascularity of the eye; a slight serous effusion only had taken place beneath the conjunctiva palpebræ. A slight puffiness is observable about the under lid of the corresponding eye, but there is no redness. Pulse soft and compressible; bowels open and tongue moist. The quinine to be continued; the wine resumed, but omitted at night if necessary.

Feb. 25. Has passed a good night and the condition of the parts is improved. The wine and bark, being too stimulating, are both discontinued. A more scarlet or what may be termed phlegmonous inflammation now surrounds the dark gangrenous portion of skin, which is about the size of a half crown in extent; and the contiguous parts have a less brawny feel. Pulse 90, soft, and the patient free from any particular pain. Wears a poultice to the part and takes saline mixture.

March 1. But little constitutional derangement is manifest. The eye examined to-day, but presented no unnatural appearance. Neither of the tarsi are implicated, although the swelling commences immediately below the lower one. To continue as before.

Mr. LAWRENCE observed, that BEER only mentions two cases wherein such a sudden change had taken place, and those resulting from the sting of bees, whereas, in the present instance, the mere contact of the leather had produced it. He also remarked that the only author who had mentioned any case like the present was M. DELPECH of Montpelier, who has described two or three cases as occurring in butchers and tanners, where the parts went into a state of mortification in the space of a day or two after the occurrence of the accident, although there was no severe contusion of the parts. He ascribes it to some peculiarity in the skin with which they were struck.

March 7. The process of separation goes on favourably; that portion of the slough which is nearest the eyelid has become detached, and is found to extend to some depth. The bowels are kept open by medicine, and a poultice is applied to the part.

March 10. A portion of the slough was removed to-day. For the last two days, as he has had a feeble pulse and complained of great weakness, six ounces of wine, daily, have been allowed.

March 13. The whole of the slough has now been detached, and, as was suspected, the tarsus is quite undermined along its central part, which has caused its dropping, and, consequently, a degree of ectropium. The surface of the sore discharges pretty freely, but has a healthy aspect. Continue as before.

March 16. Every thing to be omitted but the wine.

March 19. The edges of the sore have already considerably approximated, and the granulations have nearly rendered it a mere superficial ulceration. Continue as before. Mr. LAWRENCE says, that he shall be obliged, at a future period, to remove the everted portion of the conjunctiva palpebræ.

March 23. The ectropium is lessened, and cicatrization of the sore only now remains to complete the cure. The man was permitted to leave the hospital, and to continue his visits to the Eye Infirmary if he found necessary.

In reference to this case LAWRENCE observes, in his note, "the essential circumstances of this case were a reddened and thickened state of the skin on the cheek, just below the

eye-lid, presenting, at the first view, the aspect of incipient erysipelas; speedy mortification of the reddened part, and its slow separation, the mortification including the subjacent textures, so that the cicatrix was fixed to the bone, and the lower lid partially drawn down; absence of constitutional disturbance.

"In the other instances," he continues, "both of which were persons employed in a horsehair manufactory, the skin had sloughed before they came to the hospital. The affected portions were circular, the size of a shilling in one, on the front of the chest; that of a sixpence in the other, on the fore arm. There were no other local symptoms, nor the slightest constitutional disturbance."

Turchetti (*a*) has given, under the name of Anthrax, an account of some cases of malignant pustule, which occurred in 1841, after eating diseased flesh of cattle which had died of an epidemic anthrax of the tongue, and had been sold in the market of Fuceechio. In some persons, small, and very painful tubercles, with a red areola, or small whitish pustules, encircled with purple or violet, appeared on the face, lips, neck, or arms, gradually increasing in size until in the space of from one to three days they presented the genuine characters of anthrax. In the greatest number of these cases the slough separated in the course of a week, leaving a more or less healthy ulcer, which cicatrized speedily. In the more severe cases the pustules ran together, the inflammation spread like erysipelas, with extensive livid swelling and obstinate disorder of the alimentary canal. The sloughs did not separate for a fortnight, and left very foul ulcers, which healed with great difficulty. Two elderly persons died of this disease. A young man, eighteen years old, was attacked twenty-eight hours after taking this food with an anthrax on the left upper eyelid, whence followed mortification of the whole of that side of the face and neck, and part of the chest. At the end of a fortnight the slough cleared off, leaving an enormous ulcer, which suppurated freely and healed slowly.

Dr. Wagner (*b*) relates several cases of malignant pustule produced in man and beasts, both by contact and by eating the flesh of diseased animals, which happened at the village of Striesa in Saxony. On the 13th of July, 1834, a herd of cattle having been brought from the pastures to the village, the bull fell to the ground, and was incapable of getting up again. Supposing that it had met with some injury in the loins which would render it useless, it was destroyed by shooting through the head, as happened to be most convenient, and then, having been dressed and cut up by two labourers, the meat was distributed among the villagers. A few days after, some more cattle on the same farm died, and were skinned by the same persons; but the meat was not used as food, as almost all the persons who had eaten of the first beast had felt more or less unwell, mostly, however, complaining only of weight at the pit of the stomach, and pain in the belly, without fever: but, several, especially the two persons who had both dressed the animal and also eaten its flesh, complained severely of soreness of the limbs, dizziness and debility. Between the 15th and 18th of the month several more beasts dropped and died without any previous illness. On examining their bodies the spleen was found completely gangrenous and in so broken up a state that when cut into it presented a black paste-like mass, which readily flowed out: there were also other inflammatory marks in the belly, and hydatids here and there beneath the skin, especially about the neck. One of the flayers, notwithstanding his uncomfortable feelings, proceeded to a village three leagues off, which he accomplished; but, on attempting to return, was attacked with colic and vomiting, and some hours after was found on the ground suffering severe pain, and passing black blood by stool; his limbs were cold, and soon became attacked with cramp; the whole body like ice; the eyes sunken; and he died vomiting, passing bloody stools, and under great anxiety. One widow woman, of thirty years, who had eaten the flesh, but otherwise not touched the animal, complained of oppression at the heart, and weight of the limbs, had a black pustule on the thigh, felt herself very ill in the evening, went to bed, and early in the morning was found dead. Other persons had pustules on different parts of the body. Two very remarkable cases occurred eight days after any beast had been affected with diseased spleen; both were women, one of twenty-six, and the other of fifty years, and in them the pustules were well marked, and the general symptoms similar to the other cases. The latter patient said she had been bitten by a fly upon the back of the neck, at which part the carbuncle appeared; and the former, that she also had been bitten on the right upper arm, by a

(*a*) Sopra alcuni casi di Malattia Carbonchiosa nata per ingestione delle carni di bue perito di glosso-anthrace; in Omodei's Annali Universali di Medicina, vol. cii. p. 276. 1842.

(*b*) Uebertragung des Milzbrandgiftes auf Menschen und Thiere sowohl durch Berührung, als durch Genuss des Fleisches; in Hufeland's and Osann's Journal der practischen Heilkunde, October, 1834, p. 1.

gnat. Upon inquiry, WAGNER found that the skin of one of the infected beasts had been hung on a neighbouring wall, and thought it very possible that the insects might have been attracted to them by the smell, and had thence conveyed the poison.

A very interesting paper upon malignant pustule has within the last two years been published by Dr. BOURGEOIS (*a*) illustrated with numerous cases. He states that the disease appears in from one to three days on the point where the *virus charbonneux* has been deposited, as a little reddish spot almost always of a deep hue, sometimes accompanied with itching, at other times without. It resembles a gnat-bite, is very ephemeral, and soon followed by a little vesicle slightly puckered, of the same colour, containing a small drop of reddish serosity. Sometimes, instead of this mark, the vesicle is preceded by a solid pimple as big as a pin's head, more or less brown and rosy in some cases. The vesicle thus formed is accompanied with a sensation of great itching, and sometimes shivering, but is rarely painful. The patient scratches off the vesicle with his nail, and the itching generally ceases for a few hours, after which, around the scratched pimple, which is dry and yellowish, a regular circle of vesicles, similar to the first, but larger, are formed. In the centre of the circle, now only a few millimètres in diameter, a little brownish depression, deprived of its cuticle, and formed by the skin, on which rests the primitive ampulla, mortified, and forming a dry and very hard scar, and including the whole thickness of the skin. This continues enlarging, and fresh vesicles are formed around its margin. In from twenty-four to forty-eight hours the flesh on which the pustule rests swells, hardens, and forms a tumour more or less sensible, rarely deficient, and generally roundish, but sometimes oval, and of variable size; this he calls the *tumeur charbonneuse*, on the top of which, but rarely occupying its whole extent, is the pustule. That part not covered with vesicles is of a livid red, and spreading more or less on the neighbouring tegument. The middle part of the tumour is especially depressed, but the whole limb, head, trunk, or several of these parts, may simultaneously acquire an enormous size. As the pustule continues increasing, the redness spreads further, and fresh vesicles are developed. At this time the parts, if touched, have, in many cases, a hardness equal to that of a schirrous breast, but gradually soften at a greater distance from the centre, become tremulous, and even œdematous. But BOURGEOIS says he has never noticed the emphysema mentioned by authors, and copied by one writer from another. The heat of the diseased part, at first very great, by degrees diminishes, till it becomes quite cold. On the limbs red tracks of inflamed superficial absorbents are constantly noticed.

Before the parts in the neighbourhood of the tumour swell, there is most generally constitutional impregnation; the patient has lassitude, headache, the tongue is covered with a whitish coat more or less thick, the appetite diminishes, the pulse is full, rather frequent and soft. More rarely these symptoms do not appear till the disease is accompanied with considerable swelling.

If the disease be not arrested, the swelling extends more and more; the parts become enormously swollen, the phlyctænæ increase in number, and the scar in size, with scarcely any pain, but there is only weight and numbness of the affected parts. The general symptoms, however, become more formidable, the pulse small, quick, narrow, depressible and irregular; frequent vomiting of yellow or greenish bilious matter; violent thirst, faintings; singing in the ears; somnolence; urine scanty, red and brick-dusty; difficult motions, but at other times, and, very rarely, very fetid purging; the skin, at first hot and perspiring, becomes covered with cold clammy sweat; respiration more or less difficult; in the greater number of cases the intelligence remains undisturbed, but in some there is violent delirium. Subsequently the pulse ceases at the wrist, the body is covered with a cold sweat; the voice quenched; the skin becomes bluish; there is a sensation of burning heat within the body; unquenchable thirst; threatening suffocation; the patient cannot sit up; no urine; extreme anxiety, and finally death puts an end to this frightful condition, generally without pain.

BOURGEOIS says, that he has never observed the dull delirium mentioned in books, and that, with the exception of one case in which the patient had evidently an affection of the brain, all he saw were sensible to the last. Nor has he ever seen the enormous eschars attacking all the soft parts of a limb or spreading to a great extent, as mentioned by writers in general.

Authors have usually divided the disease into four stages, without including that of the incubation of the disease: these, however, BOURGEOIS considers arbitrary, and thinks that there are only two distinct periods in the course of malignant pustule; the first commences with the appearance of the primitive malignant spot, which he calls the

(*a*) Mémoire sur la Pustule Maligne, spécialement sur celle qu'on observe dans la Beauce; in Archives Générales de Médecine, &c., Fourth Series, vol. i. pp. 172, 334. 1843.

local period or *first period*. The second, which he designates under the name of the *period of impregnation* or *intoxication*, commences with the first general symptoms and terminates only with death or cure." The course of the disease is very variable; it may terminate in two or three days or extend to the fourteenth. The first period is generally the shortest but he has noticed it running on to the fifth day; the second varies from thirty-six hours to eight or nine days.]

For the Literature of Malignant Pustule, see p. 97.

35. Hospital Gangrene (*Gangræna nosocomialis*, Lat.; *Hospitalbrand*, Germ.; *Pourriture d'hôpital*, Fr.) consists of a peculiar decomposition of organic parts appearing under manifold forms. A wound or sore begins to be painful, the edges inflame, the suppuration becomes less and of a serous character. Some days after, on certain parts, or on the whole extent of the wound appears a whitish, thin, semi-transparent membrane pretty firmly connected with its surface, which increases in thickness and extent, and gives the whole surface a grayish-white appearance. This mass cannot be removed, and, if it be attempted, only a part of the whole which is firmly connected with the wound, can be removed. The wound increases in all directions; the edges become still more painful, œdematous, and the œdema spreads. Sometimes hospital gangrene commences also with painfulness of the suppurating surface; but upon it are observed more or less deep cavities, the edges of which are dusky red, and covered with yellowish, white, consistent pus. These ulcerous spots increase and run together; a bloody ichorous fluid is secreted, and the surface of the sore increases in all directions. Lines of inflamed lymphatic vessels commonly stretch to the neighbouring glands. The destruction is often restricted to the cellular tissue; but, in more decided cases, the muscles and all parts without distinction are destroyed. Bleeding often occurs from the destroyed vessels. The bones resist for a long while, but finally give way.

With these local appearances there is always loss of appetite, pain in the region of the stomach, disposition to vomit, costiveness, loss of sleep, a quick and rather weak than strong pulse, hot skin, great anxiety, and restlessness. In the more severe form of the disease all the symptoms of typhus fever come on. These general symptoms often precede the local. The severity and course of this disease as well as its continuance vary in different persons. If it be long continued or often recur, hectic fever and exhausting purging at last set in.

In some cases the hospital gangrene arises in form of a little inflamed pimple or vesicle, without any preceding injury to the part being perceptible (*a*). Hospital gangrene is quite different from the scrofulous complication of sores and wounds.

[Liston (*b*) gives the following brief account of hospital gangrene, as it appeared in University College Hospital, in the year 1841. The case he mentions followed the removal of some metacarpal bones and fingers. "All at once, the stump, which had been healing kindly, assumed a carious appearance; it became enormously swollen within a few hours, and profuse hæmorrhage took place, which there was considerable difficulty in stopping. This might have been, and was sure enough by some who saw it, taken for malignant disease; but it was exactly like what I had seen before in unhealthy seasons, and in badly-regulated hospitals. The season was a very severe one; there had been a great snow-storm, with very cold weather of long duration. Not many days passed over before a number of wounds assumed the same appearance; the parts got puffy round about them, the discharge became slimy and tenacious, very putrid; and bloody fetid gas filled the cellular tissue around them. They extended rapidly, presenting a circular form. Many patients lost a considerable quantity of

(*a*) Thomson, as above, p. 460.
(*b*) Lectures on the Operations of Surgery, &c, in Lancet (New Series), vol. i. p. 57, 1844-5.

blood; in fact, we were visited by a rather rare disease, hospital gangrene, one which I trust I may never see again. Luckily, out of a good many patients who were so attacked, and in all parts of the hospital almost simultaneously, not one perished. Many of the wounds and ulcers were frightfully extended; but they speedily got clean, and healed soon afterwards very kindly. * * * After the separation of the sloughs, a *circular* clean granulating surface was left. We were at a loss to account for this invasion: there was nothing as regarded the hospital, its ventilation, or drainage, or management, the dressing of sores, &c., that could be blamed. The disease came upon us suddenly, and as suddenly disappeared; and I need not tell you that we have seen nothing of the kind since."

My friend ARNOTT informs me that in January, 1835, in one of the female wards of Middlesex Hospital three cases occurred which might be classed under the head of hospital gangrene, of which the following is a short account:—

CASE 1.—The disease attacked a common ulcer of the leg; the surface became black and pulpy, with a broad very red margin of integument, a raised edge, and great pain. From the size of half-a-crown, the disease extended and occupied, ere it was stopped, a space of a large wash-hand saucer, exposing the muscles and bone. It was arrested by the application of pure nitric acid, and the removal of the patient into another ward.

CASE 2.—The disease appeared on an ulcer by the side of the anus, presented the same character, but was arrested by balsam of Peru, locally, and a grain of opium every six hours, internally. The disease recurred, and the patient was removed from the hospital.

CASE 3.—A punctured wound of the chest did not heal, but that of the integument enlarged by the conversion of the tissue into a grayish pulpy substance, (not black, and without the fiery margin and intense pain of the other cases,) more like phagedæna. It was stopped by balsam of Peru. "I have never seen," he says, "a similar case in the Middlesex Hospital before or since."

I have mentioned the above cases of hospital gangrene, because they are, as far as I can ascertain, the only instances of the disease which have been seen in either of the London hospitals for many years. Cases occurred many years since in the old Westminster Hospital, and also in the York Hospital at Chelsea, which latter being a military establishment, the disease was believed to have been brought home by the sick and wounded soldiers from abroad. With these exceptions, I have the best grounds for stating that in no other hospital in London has it existed in the memory of either of the present surgeons; so that it is a disease entirely unknown to them, excepting to the few who have seen it elsewhere.

LAWRENCE (*a*), speaking of sloughing phagedæna, observes "that these occurrences generally take place in women of the town under the particular circumstances I have now stated; but it is by no means exclusively confined to cases in which the origin might be supposed to be *venereal*. I remember a very bad instance in this (St. Bartholomew's) hospital, in a case that was under the care of Dr. LATHAM, by whom I was requested to see it on account of the sloughing phagedæna. It was a young woman who had had the small pox very badly. The disease had rendered her very weak, and diarrhœa came on. There was a considerable discharge from the vagina, and a constant moisture of the parts by a discharge from the rectum. Thus the skin of the nates became highly inflamed, and in fact a large excavation of sloughing phagedæna formed on each buttock, and she was reduced to a very low state by the disease. Dr. LATHAM asked me what I thought could be done; and, having examined her, I thought badly of the case, but that we might destroy the excavations in her buttocks, which were nearly as large as a good sized teacup, and possessing all the characters that I have mentioned. They were treated by nitric acid applied with lint wrapped round the end of a probe till the sore was saturated with it, and a brown escar produced; the surrounding parts having been previously well dried, to prevent the spreading of the acid beyond the sore. Port wine was liberally allowed her and she got well. This was a cause of a common kind, in which you could not ascribe the effect to syphilitic disease. Now, as far as I can understand the affection called *hospital gangrene*, it is the same as the sloughing phagedæna I have now described." (p. 454.) I think there is little doubt that this was a case of hospital gangrene and not of the so-called sloughing phagedæna. But it is difficult to make out whether LAWRENCE holds them as distinct or as the same disease; though probably the former, as, in speaking of "the treatment" of hospital gangrene, specially, he says, it, "in other respects, is the same as I have mentioned for sloughing phagedæna." (p. 455.)

(*a*) Lectures, as above.

I cannot agree with SAMUEL COOPER, that the sloughing phagedæna, of which an account, founded on the cases to which LAWRENCE refers in his Lectures, is given by WELBANK (*a*), "certainly resembles hospital gangrene," as described in books. The sloughing phagedæna was certainly an endemic supervening on venereal excoriations or sores, and *not* hospital gangrene. I shall advert to it hereafter, in speaking of chancre, or venereal ulcers.

The only cases that I have seen, with the slightest resemblance to hospital gangrene, were the sloughy stumps now and then occurring, perhaps more frequently during those years, formerly, when our wards were much troubled with erysipelas. The operation would either seem to be going on favourably for two or three days, the patient comfortable, and adhesion in progress, when a sudden change would set in, the stump become painful, swollen, hard, and red, the un-united part become sloughy, and the united part falling asunder, and soon also becoming sloughy; or, the stump never making any attempt at union, but soon becoming painful, swollen, and sloughy. In either case, the patient himself hot, dry, flushed, with brown tongue, and foul alvine discharges, the pulse quick, irritable, delirium and death supervening. I said such cases occurred, perhaps, more frequently when erysipelas was rife; but they really do happen when no erysipelas is in the ward at the time, nor has been for many months, and they occur not unfrequently in primary amputations in stout persons who have been accustomed to large quantities of beer or spirits, or of both, and from which they are not unfrequently entirely at once (and, as I consider, improperly) debarred; and hence, with a greater call than usual upon the powers of the constitution, are left to meet it with diminished means. Such cases are to be considered merely as resulting from want of power; but they are never epidemic or contagious, and must not be confounded with, hospital gangrene, which, however frequent it may be elsewhere, is, in London, at the present time, and has been for years, unknown by personal experience to most hospital surgeons.—J. F. S.]

36. The characteristic of hospital gangrene is its quick extension and the decomposition of the tissues without any special residue; if the grayish-white mass in certain cases be not so considered. Hospital gangrene is an extension of a wound or of a sore intermediate between ulceration and mortification.

37. The cause of hospital gangrene is the operation of a peculiar contagious matter, either upon wounds and the ulcerated parts or upon the whole body. The contagion develops itself usually in hospitals, where the air is deteriorated, many patients huddled together, and the bandages not kept clean; specially in unhealthy places, as gaols and so on. We know not how long the contagious matter may retain its activity. Probably the constitution of the atmosphere, the weather and climate influence the development and character of hospital gangrene. The susceptibility to contagion is not diminished by its having once been acted upon; on the contrary, it seems to have increased. The contact of the contagious matter with the wound is either the consequence of want of care in dressing it, its long exposure to the action of the air infected with contagion, or its having been covered with bandages in which the poison is retained. The contagion may happen to every person, and in every kind of wound and ulcer: it rarely, however, alters specific ulcers, whilst on the contrary a bilious constitution, mental affections, great feebleness, typhus fever, appear to be most favourable to it. The character of the disease itself may be changed by the constitution of the patient, and by the state of the weather; it may even become inflammatory, in which case the wound is encircled with a red ring, the pain is severe and throbbing, the pulse quick and hard, and the bleeding which occurs produces relief. Hospital gangrene is always a very dangerous complication of wounds and sores. Accidental circumstances may render the danger still greater; for instance, if it be impossible to give the patient

(*a*) Medico-Chirurg. Trans., vol. xi. 1821.

attacked with the disease better air and better nursing, and so on. Left alone, hospital gangrene is usually fatal. If it have proceeded to a certain extent, art is rarely of any avail.

For the Literature of Hospital Gangrene, see p. 98.

38. After the appearances and terminations of inflammation, which have been described in general terms, we now come to those variations which inflammation may offer to our notice.

The existence of inflammation depends always on unnaturally raised vital processes: manifold circumstances, however, may change the appearances and course of inflammation, and these changes are only to be considered as modifications of simple inflammation; and the more so, the less they correspond to what we understand by increased vital action. The inflammation may be classed, 1st, *according to its appearances and course*; 2nd, *according to its causes*; 3rd, *according to the structure of the parts attacked.*

39. If the inflammation make its appearance with a certain intensity of its symptoms, and proceed rapidly, it is called *acute*; but, contrariwise, *chronic*, when the intensity of the symptoms is slight and their duration protracted, which condition may be either primitive or consecutive, depending on the constitutional condition. In regard to its character inflammation is further divided into *simple*, *erethitic*, *torpid*, *malignant*, and *obscure*. In *simple inflammation* all the symptoms of inflammation are present in a corresponding degree; it runs a speedy and most commonly satisfactory course; it is almost peculiar to strong persons, who have good health; its termination, if not resolution, is generally suppuration. The *erethitic* and *torpid* character of inflammation are merely modifications according to the *constitution of the patient* and the *degree of the inflammation*. In the *erethitic inflammation* the symptoms have not the same degree of severity as in simple inflammation; the sensibility is, however, distinctly increased, and it therefore especially appears in persons of delicate constitution. The *torpid inflammation* has a remarkably tedious course, and its symptoms seem to depend rather upon a local obstruction of the circulation in the capillary-vascular system than upon an accelerated vital activity; all the signs of active congestion are wanting, the part is not bright red, but dusky and brownish. It occurs specially in weak, reduced, cachectic subjects. Simple inflammation may also, under improper treatment, assume a torpid character. *Malignant inflammation* (*Inflammatio maligna*, *gangrænosa*) is often painless, or accompanied by an obtuse, heavy pain and dusky redness: its cause is sometimes manifest as the effect of deleterious or contagious matter; at other times, it is unknown: it supervenes on typhus and putrid fevers, and usually runs into gangrene. *Obscure inflammation* (*Inflammatio occulta*, *clandestina*) is that which is little or not at all indicated by symptoms.

40. Inflammation is divided, according to its different causes, into *idiopathic*, *symptomatic*, *specific*, and *sympathetic*. *Idiopathic inflammation* is the consequence of external violence; it exists as a local disease, and its severity is regulated by the degree of the injury and the condition of the subject. *Symptomatic inflammation*, at least the definite form under which it first appears, depends on internal causes, and the inflammation itself is to be considered only as a reflection of the general disease. If this be of a specific nature, as syphilis and so on, the inflam-

mation is said to be *specific*. *Sympathetic inflammation* is the consequence of a consensual change in the mutual relations which one part holds to another, by which their diseased affections become shared by both. The *metastatic inflammation* which passes from one organ to another is in close connexion with the sympathetic.

Symptomatic inflammation is either the original symptom of general disease, or an originally idiopathic inflammation acquires, through the general disease, a definite character.

41. In whatever part inflammation may occur, its peculiar seat is always in the *capillary-vascular* system. But its symptoms vary according to the different conditions of the affected part.

Inflammation of the *Skin*, if not severe, terminates in resolution with scaling of the cuticle, and not unfrequently also with dropsical swelling. In a more active inflammation a fluid is poured out beneath the cuticle producing vesications and pustules. If the inflammation be tedious without being active, the cuticle is destroyed; the fluid poured out by the exposed vascular net thickens into crusts. If the inflammation extend to the subjacent cellular tissue, it is generally severe and runs into suppuration.

Inflammation of the *Cellular Tissue* is usually accompanied with much ill-defined redness, with firm elastic swelling, much tension and throbbing pain; it does not resolve except it be in a mild form; its usual termination is suppuration, not unfrequently gangrenous destruction of the cellular tissue.

[This important affection of the cellular tissue, which has only within the last twenty years been particularly noticed, though commonly spoken of under the common title of erysipelas, is described more at length by our author, at page 103, "as a metastatic deposit in the cellular tissue, and one of the causes of his *Erythema symptomaticum seu consensuale*. Doubtless, it may be, and occasionally is, metastatic; but, generally it is idiopathic. It has of late years become common, and is a very rapid and dangerous disease, unless early and properly treated. Its importance is so great, that it is as fully entitled to a proper chapter as erysipelas, from which it most decidedly differs. But it will be, perhaps, more convenient to insert what I have to add where the subject comes under consideration in our author's arrangement, rather than to remove and drag his paragraphs into places for which he had not intended them, under pretence of making his meaning more clear, as if the author did not best understand his own view of the subject he discusses; a proceeding which has been occasionally practised in English translations, which I think cannot be too much deprecated, and the least inconvenience of which is, that it is not unfrequently impossible to refer from the original to the translation, or from the translation to the original.—J. F. S.]

Inflammation of the *Glands* mostly exhibits not very acute but rather dull pain, no great heat, very solid circumscribed swelling, which also extends itself into the surrounding parts. Its termination is similar to that of inflammation in the cellular tissue, except that glandular inflammation most commonly assumes a chronic character, and then easily passes into hardening.

In inflammation of the *Mucous Membranes*, their secretion is stopped at the onset; at the same time, increased warmth and sensibility, heavy pain and great redness make their appearance, a secretion of thin somewhat acrid fluid, the thickness of which increases, becomes creamy, and of perfectly mild character. No tissue so readily as the mucous membrane acquires a morbid disposition to inflammation. When affected with long-continued inflammation their spongy cellular tissue becomes loosened, swelled, thickened, and the vegetation on it often is so changed that new formations, polypous excrescences, are developed. In active

inflammation, or in long-continued flow of mucus, ulceration and destruction of the underlying parts frequently occur. Very rarely do inflamed mucous membranes become adherent.

[In reference to the kind of inflammation which occurs in mucous membranes, HUNTER says:—"In internal canals, (I make a difference between an internal cavity and a canal; they are very different in their construction, their uses, and also their mode of action in disease are very different,) where adhesions in most cases would prove hurtful, the parts run immediately into the suppurative inflammation, the adhesive inflammation in common being excluded; such parts are the internal surface of the eyelids, nose, mouth, trachea, air-cells of the lungs, œsophagus, stomach, intestines, pelvis of the kidneys, ureters, bladder, urethra, uterus, vagina, and indeed all the ducts and outlets of the organs of secretion, which all these parts mentioned may be in some degree reckoned, and which are commonly called mucous membranes. In such parts, if the inflammation is but slight, the suppurative in common takes place, which is almost immediate, as it is not retarded by the adhesive stage, which accounts for the quickness of suppuration of these parts in many cases. * * * Since those surfaces are, in general, secreting surfaces, suppuration would appear to be only a change in the secretion; and I think I have visibly seen, or could visibly trace, the one change gradually leading into the other; the different parts, therefore, of which the pus is composed, will not always be in the same proportion, so that the matter will seem to vary from true matter towards that of the common secretion of the part, and *vice versâ*; but this does not alter the position, for it is common to matter from a sore, and even common to our ordinary secretions. If this inflammation which produced suppuration on those surfaces becomes more violent, or has something of the erysipelatous disposition, we find that it moves from the suppurative to the adhesive, and throws out the coagulating lymph." (p. 241, 2.)]

The *Serous Membranes* have great disposition to inflame; the inflammation is very painful, usually appears suddenly, spreads quickly, and easily passes into resolution, adhesion, transudation, and mortification, but rarely into ulceration. Serous membranes often thicken, either by the cellular tissue upon their external surface or by plastic membranes, or even in their own proper substance. Chronic inflammation of *serous membranes* appears mostly in the form of dropsical affections.

[Serous membranes are the circumscribed cavities which, with "the cellular membrane or the body in general," belong to the first order of parts into which the body is divided by HUNTER, and in relation to which he observes:—"When inflammation takes place in the first order of parts, it is commonly the adhesive; but it will be according to circumstances whether the suppurative or the ulcerative follows first." (p. 253.) "The adhesive inflammation serves as a check to the suppurative, by making parts which otherwise must infallibly fall into that state, previously unite, in order to prevent its access, as was described in the adhesive inflammation being limited; and, where it cannot produce this effect so as altogether to hinder the suppurative inflammation itself from taking place, it becomes, in most cases, a check upon the extent of it" (p. 365;) of which inflammations of the pleura, or surface of the lungs, presents a good example; "the adhesive inflammation takes place, and the surfaces are united, which union going before the suppurative confines it to certain limits, so that distinct abscesses are formed in this union of the parts; and the whole cavity of the thorax is not involved in a general suppuration." (p. 366.)

The peculiar disposition of serous membranes to assume in preference adhesive inflammation is remarkably contrasted with the equally special preference of mucous membranes for the suppurative inflammation. The construction of closed cavities by the serous, and of canals by the mucous membranes, afford the ready explanation of these peculiarities. Any opening, therefore, in a serous membrane puts it in an unnatural condition, and, consequently, if it were attacked with suppurative inflammation, the pus produced requiring an aperture for its escape, such unnatural state would be induced, and the functions of the membrane interfered with or destroyed: therefore, most commonly, adhesive is the kind of inflammation occurring, which only diminishes the cavity (the lesser evil) without opening it; and when, more rarely, suppurative inflammation ensues, it is most usually shut off from the general cavity by adhesive inflammation, as in spurious empyema; and only in few cases existing without such adhesion. Whilst, on the contrary, were mucous canals attacked with adhesive inflammation, they would

be at once blocked up and the most dangerous consequences ensue, as occasionally observed in croup, and so on; but they prefer suppurative inflammation, and no such danger accrues.—J. F. S.

The inflammation of serous membranes sometimes runs on to suppuration. This was noticed by HUNTER, who observes:—"In spontaneous suppurations, one, two, three, or more parts of the inflammation lose the power of resolution, and assume exactly the same disposition with those of an exposed surface, or a surface in contact with an extraneous body. If it is in the cellular membrane that this disposition takes place, or in the investing membranes of circumscribed cavities, their vessels now begin to alter their disposition and mode of action, and continue changing till they gradually form themselves to that state which fits them to form pus. * * * From hence it must appear that suppuration takes place upon those surfaces without a breach of solids or dissolution of parts, a circumstance not commonly allowed; and, when got beyond the adhesive state, they become similar in their suppuration to the inner surfaces of internal canals." (p. 378.)]

In inflammation of the *Fibrous Tissues* the pain is sometimes very severe, sometimes changeable, deep-seated, increased less by pressure than by the motions of the part, the warmth is much increased, the swelling, according to the difference in structure of the neighbouring parts, sometimes hard, sometimes soft, the redness slight, often scarcely discernible, but often far outspread. Its terminations are resolution, metathesis, gouty concretions, gangrene, and suppuration, which is confined to the cellular tissue connecting the fibres together, whereby a laminated arrangement is produced.

Inflammation of the coats of *Arteries* (1) is either generally diffused, with violent pulsation of the heart and arteries and high fever; or it is confined to one spot, when the symptoms are commonly obscure. The acute *partial* inflammation of arteries commonly runs into adhesion; the *chronic*, which mostly depends on diseases with little power, into thickening, loosening, ulceration, deposition of calcareous masses, whence (2) commonly results the origin of aneurisms.

[(1) Arteritis, as it is now generally called, is, probably, if idiopathic, an inflammation of the internal only, and not of all the coats of an artery, but, if traumatic, arising either from wound, from ligature, or more extensive pressure and the like, or if the inflammation have been communicated to the artery from neighbouring diseased parts then all the coats of the vessel become affected, and may pass through the various forms of inflammation. "The active and violent pulsations," says BOUILLAUD (*a*), which the arteries in the neighbourhood of a very acute whitlow perform are the type of those which characterize general arterial irritation. And he also observes, that there is besides the increased force of the arterial pulsations, a sensation of heat and uneasiness in the region which the inflamed artery occupies." (p. 411.)

Redness, thickening and friability are the appearances described as presented by the internal coat of an artery under acute inflammation; the redness and thickening from swelling of the membrane occurring simultaneously.

HODGSON (*b*) describes four cases, in the first of which the internal coat of the aorta was of deep red colour; a great effusion of lymph had taken place into its cavity, and become very intimately connected with the internal coat, and a plug of the lymph extending into the left sub-clavian artery nearly obliterated its cavity: these appearances accompanied a violent pneumonia. In three cases, viz. of carditis, pneumonia and bronchitis, he also saw it, but the effusion of lymph was less; in one case the aorta was throughout of a deep scarlet colour, and a little above the semi-lunar valves the coats of the aorta were distended with lymph. (p. 5.) He also quotes from PORTAL (*c*) a case of sudden subsidence of measles, in which "the aorta was throughout nearly its whole extent very red, and its walls swollen and soft, especially in the thoracic region, near the diaphragm, where it was covered with varicose vessels; the internal coat was swollen and softened." (p. 127.)

(*a*) Dictionnaire de Médecine et de Chirurgie Pratiques, vol. iii. Article *Artérite*.

(*b*) On the Diseases of Arteries and Veins, &c., London, 1815, 8vo.

(*c*) Anatomie Médicale, vol. iii. Paris, 1803. 8vo.

Redness, however, is not always present in an inflamed artery, and it often exists when there is not any inflammation, when putrefaction has commenced, in consequence of the blood transuding. And BOUILLAUD says:—"It is right to observe, that the redness of the internal membrane of arteries, even in the case where one is disposed to refer it to acute arteritis, is not produced, at least in the great majority of cases, by a *capillary injection*, but rather by a kind of *tinting* or *fixation* of the colouring matter of the blood on the internal membrane. Under this new point of view the inflammatory redness differs not essentially from that which is called *cadaveric*." (p. 403.) In inflammation of the whole thickness of the arterial walls, the outer coat is generally red, in consequence of the active and free injection of the numerous vessels which everywhere penetrate them; and sometimes there is even a slight infiltration of blood. BOUILLAUD further observes, that "after the internal coat, or even all the coats of an artery has been some time inflamed, it is easily detached in large flakes, the subjacent cellular tissue becoming friable." I apprehend, however, that what he considers as flakes of the internal coat are really deposits of adhesive matter upon the coat, and not portions of the coat itself. The result of acute arteritis is then deposit of adhesive matter, and, as already mentioned in one of HODGSON'S cases, sometimes sufficient to fill up the tube of the artery, though, from the friction of the stream of blood upon the deposited lymph, BOUILLAUD considers that it is drawn into the stream, and that rather the "inflammation determines the coagulation of the blood circulating in the artery, and thus is easily explained how the secreted matter in addition to the mass of coagulum, may produce arterial obliteration." (p. 407.)

Adhesion of the lining membrane, and obliteration of the arterial tube, is one of the results of arteritis; but, as will be presently shown, the effusion of adhesive matter, and even the coagulation of the blood in the inflamed vessel, do not always cause mortification of the limb, as DUPUYTREN would seem to consider; that condition depending rather on the number of the vessels affected with inflammation, and the quickness with which the adhesive deposit takes place, so that the supply of blood is cut off before the collateral circulation can come into play. The usual consequences of inflamed artery are seen in the application of a ligature upon an artery, in which case generally the collateral circulation is speedily established and no inconvenience to the limb is sustained, whilst, on the other hand, occasionally the circulation is restored so slowly that mortification to greater or less extent ensues.

The following case of partial arteritis came under my own care, and for its previous history I am indebted to my intelligent friend CRISP of Walworth, whose patient he was.

Thomas Batt, aged 21½ years, a grocer's assistant, about five years prior to the present time, (August 1843,) had an attack of rheumatic fever which lasted six or seven weeks; and since has had several slight attacks of pleuritis, for one of which he was bled, but neither were so severe as to confine him to bed. The bellows sound was always heard over the region of the heart. On the *7th of August* he was seen on account of slight pain in the chest, for which he was ordered some aperient medicine with *vin. antim. potass tart.* The pulse at the left wrist was then felt and *nothing remarkable* observed.

August 9. A. M. Whilst putting on his waistcoat, he was struck with pain like the prick of a pin, about the middle of the left upper arm, and in the track of the brachial artery, which continued for about an hour, and during that time his arm "became dull and cold as low as the elbow." He saw his medical attendant at 10 A.M.; the arm and hand were then cold, and no pulsation could be felt below the arm-pit, at which part the artery was felt beating, but not forcibly, (90 a minute,) and over it great tenderness on pressure. The pulse of the right wrist was 100, and rather more powerful than usual. The ailing arm was ordered to be put in warm water for a quarter of an hour.

4½ P. M. In the same state as the morning; but has had five or six times a sensation of throbbing in the arm, with tingling and numbness of the fingers.

10 P.M. As he continued much the same, six leeches were applied to the arm-pit, and an opening draught given immediately.

August 10, A. M. Caustic was applied to the leech-bites, which had bled all night and were still bleeding, so that he felt rather faint from loss of blood; but the pulse of the right arm is not much affected. No pulsation in the left wrist; but the hand less cold than yesterday. There is great tenderness over the commencement of the brachial artery. ℞ *pulv. colchic., pulv. antim.*, āā gr.v. *hydr. c. cretâ*, gr. x. *quintis horis sum.*

August 11. Much the same: the artery painful on pressure; the powders continued.

August 13. No change since the last report, except that the tenderness over the brachial artery is less and the hand not so cold. His bowels being confined, an aperient draught was ordered immediately, and the powders continued.

August 15. He came under my care at St. Thomas's, and, in addition to what has been already mentioned, he says, that he has long had a sense of weakness as if overworked, and that during the first day of the attack, the dullness and coldness continued extending down to the wrist, but unaccompanied with pain; that for the last two nights his arm has been affected with dull aching pain which has prevented his getting rest, but has subsided during the day. At present he is free from pain, except when the arm is bent or hanging down, under either of which conditions he has pain at the original spot in the middle of the arm. He has much tenderness on slight pressure from the middle of the arm upwards, and the arm-pit in the course of the artery, but none below. The pulsation in the brachial artery below the specially indicated part, is scarcely, if at all perceptible, and above it is slight; at the wrist, in the ulnary artery, there is not any pulsation, but the radial artery pulsates slightly. The pulse of the right wrist is distinct, full and quick. I ordered bleeding from the right arm to twelve ounces, milk diet, and *liq. ant. potass. tart.* ℥ x. *ex mist. potass. citr. 4tis*

August 16. He has been relieved by the bleeding; has less pain and more feeling in the arm.

August 17. A careful examination by the stethoscope indicates regurgitation through the aortic valves.

August 22. Complains of having had occasional shooting pain in the fore and middle fingers of the left hand, as if being cut off. No increase of pulsation at the wrist; the upper arm is less tender. He complains of having had pain in the sole of the left foot two days since, which yesterday extended into the great and second toe, so that he could not bend them without much pain; in course of the day the pain subsided at this part and attacked the dorsum pedis, where it yet remains, though less severe than yesterday.

September 5. Pulsation in the left radial artery is now very distinct though small.

September 26. On examination with the stethoscope, distinct bellows murmur with the second sound most decidedly over the aortic valves, and the first loud, short and clear: pulse jerking, regurgitation through the aortic valves, and dilatation of the heart.

October 4. The pulsation at the wrist still continues steady. He complains of having cough with expectoration and want of rest at night; is languid and thin, and his health not improving. ℞ *pil. opii. gr.* 1 *o. n.*, which was, on

October 24. Replaced with *tinct. camph. comp.* ʒj *ex mist. amygd. ter in die*, and, on

October 27. The opium was resumed. He has been gradually becoming more languid without any very distinct cause.

November 3. He spat a little blood, which continued increasing by degrees till

November 5. When he spat a large quantity, and died in the evening. During the last three days he has been so much exhausted, that it was absolutely necessary to keep him up with arrow-root and port wine four ounces daily.

EXAMINATION.—*Chest.* Some old pleuritic bands on the left side, but none on the right; the left pleural cavity containing a considerable quantity of serum.

Pericardium universally adherent; its free portion separated from the visceral with great difficulty. Heart enlarged; its apex wide and rounded: both ventricles enlarged; the walls of the left thickened, and those of the right somewhat thinned. Valves on the right side perfectly healthy. On the left the sigmoid valve of the aorta thickly beset or fringed with vegetations. The curtains of the mitral valve thickened and containing points of cartilage and bone. Both aortic and mitral orifices contracted, mainly dependent on the thickening of their individual valves.

Belly. Liver rather enlarged, dark-coloured, and in a state of hepatic venous congestion.

Left Arm. Brachial artery high upon the arm over a space of from half-an-inch to an inch, of a red colour, and its coats thickened, containing at this point a plug of coagulable lymph adherent on one side to the lining of the vessel. Below this part the vessel was much contracted to the extent of three or four inches, beyond which it again resumed its original calibre, and there the orifices of three or four minute vessels were perceived.

Adhesive matter may be deposited between the internal and middle coats of an artery, and even pus, of which an instance is mentioned by ANDRAL. The internal coat of the aorta "was elevated by half-a-dozen little abscesses, each about the size of a hazel nut and situated between it and the middle coat; the pus contained in these abscesses resembled the usual pus of phlegmon." (p. 379.)

(2) The deposit of earthy matter in arteries generally involves only their coats, especially the inner coat; upon the exterior of which the earth is held to be deposited, in consequence of the thin internal coat being usually traceable and separable from it, so

that the earth is not in immediate contact with the stream of blood. This, however, is not always the case, for the lining coat sometimes appears to be deficient, or hangs in shreds into the tube of the artery, so that the blood does actually flow in contact with the earthy matter, and the latter is occasionally deposited in such quantities that it completely fills up the cavity of the artery, rendering it impervious, and converting it as it were into a calcareous rod, the particles of which, however, are not in very intimate union: an excellent instance of such conversion of the femoral artery is in the Museum of St. Thomas's Hospital.

The deposition of calcareous matter in the coats of arteries is not restricted to old persons; for PORTAL observes:—"The vessels of young persons rarely ossify; instances, however, have been noticed of ossifications in the arteries of some children, in whom the ossification of the bones had not proceeded far." (p. 133.) HODGSON also mentions, that "George Young possesses a temporal artery, which he removed from an infant of fifteen months old, in which the coats of the vessel are converted into a complete tube of calcareous matter." (p. 23.)

The analysis of the earthy concretions made by BRANDE for HODGSON presented 65.5 of phosphate of lime, and 34.5 of animal matter in 100 parts; the latter consisted chiefly of albumen, with traces only of gelatin. No carbonate of lime was discoverable.—J. F. S.

These earthy deposits are not bone as appears from the following statement of MIESCHER (*a*):—"Ossifications of all the arteries very frequently occur which are situated between the innermost and proper tunic, in form of larger and smaller plates, of which the smooth surface turned towards the cavity of the artery, the colour, density and toughness very closely resemble true bone; but, when broken, they always had to me a foliaceous or squamous appearance, very like the scales of an oyster-shell; nor could I ever, though often seeking with the microscope, discover corpuscles or canalicules; the soft substance left after the addition of hydrochloric acid never presented any definite texture." (p. 46.)]

Inflammation of the *Veins*, when partial, manifests itself by the symptoms of inflammation in general; but, when it spreads further and attacks the large venous trunks, then appear violent symptoms, such as a rapid pulse, depression, restlessness, delirium, and so on. The cause of inflammation of the veins is most commonly external injury. Its terminations are, 1st, thickening of the venous coats; 2nd, stagnation and formation of clots; 3rd, effusion of plastic lymph and obliteration; 4th, formation of pulsating swelling; 5th, suppuration and bursting of the venous walls; and, 6th, ossification.

According to CRUVELHIER (*b*), the symptoms in adhesive phlebitis, as well as in circumscribed suppurative phlebitis, are entirely local, and originate in irritation of the internal coat of the vein, and in the mechanical obstruction, which, by stopping up the veins or the branches of the inflamed venous twigs, opposes the passage of the blood and of the lymph. The pain and fever depend on the inflammation, and the œdema upon the mechanical obstruction to the circulation. In the uncircumscribed suppurative phlebitis, the symptoms depend on infection of the blood. The patient passes suddenly and without intermission from a state not seemingly dangerous to stupor, prostration of power, and to death, like an animal into whose veins pus has been injected.

[Inflammation of the veins or phlebitis as it is now generally called is far from an infrequent disease, and when very active is extremely dangerous. As our author states, the cause of this disease is most commonly external injury; but I have known it to arise spontaneously in the leg, where the veins have had a varicose disposition. The track of the inflamed vein is easily distinguished by its redness, by its feeling like a cord of greater or less length beneath the skin, as thick and sometimes thicker than a goose-quill with protuberances at uncertain distances corresponding to the situation of the valves. This cordlike character depends upon the coagulation of the contained blood, "the coagulating lymph (fibrin) undergoing," as HUNTER (*c*) observes, "some changes in its passage through the inflamed vessels, which obliges it to coagulate more immediately or much sooner than it would otherwise; for, in those cases of inflamed arms after bleeding, and in inflammations in consequence of other causes, we find that the cavities of the veins are in many places furred over and in others united by means of the coagulating lymph. Now, if this coagulating lymph is similar in its productions to that

(*a*) De Inflammatione Ossium eorumque Anatome generali. Berolini, 1836. 4to.
(*b*) Anatomie Pathologique. Paris, 1837.
(*c*) On Inflammation, &c.

which we have been describing, it must have been thrown out from the vasa vasorum, these vessels having separated it and poured it into the cavity of the veins, and it must there have coagulated immediately: in this separation, therefore, from the blood, it must have undergone some change, arising from the action of the vessels; for, if this lymph was no more than the coagulating lymph, with its common properties, or the properties common to that which is circulating in the same vein which receives it, it would in such cases only continue to throw in more coagulating lymph, in addition to what was circulating, and therefore probably it would be carried along with the blood to the heart as a part of the common mass. From this we should infer that this coagulating matter is not simply the coagulating lymph such as it was when circulating, but somewhat different, from having undergone a change in its passage through the inflamed vessels, partaking of the disposition of those solids through which it passed. * * * But this may be taken up in another point of view, and upon the same principle; the inflamed vessels may give a disposition to the blood as it is moving slowly along, to coagulate on its surface, and this is probably the more just idea of the two; as we find that the vessels both veins and arteries can give this disposition, and to a very great extent: we find, in the begining of mortification, the blood coagulating in the vessels so as to fill them up entirely, and this, preceding the mortification, seems to be for the purpose of securing the vessel before it is to give way; we, therefore cannot doubt of a coagulating principle being given to the blood from the vessels." (pp. 311, 12.)

Accompanying the redness and cordlike feel there is more or less tenderness, and even actual and severe pain. The inflammation continues to extend towards the heart, presenting, as it proceeds, the same characters. Not unfrequently a chain of little abscesses take place generally at the protuberant valves, which burst of themselves, but are best laid open. The constitutional excitement varies considerably, sometimes is trifling, but sometimes very severe. With constitutional and local antiphilogistic treatment, bleeding, fomenting and poulticing, the disease, however, is not unfrequently checked, the inflammation subsides, and the cordlike condition alone remains, which requires some time for its removal. If suppuration in form of little abscesses, as just mentioned, occur, the inflammation oftentimes ceases, and the case does well; but, if suppuration do not occur, then the disease becomes dangerous.—J. F. S.

Attention has long been drawn to the severe form of phlebitis; for, more than fifty years since HUNTER (*a*) observed that "in all cases where inflammation of veins rises high, or extends itself considerably, it is to be expected that the whole system will be affected. For the most part, the same kind of affection takes place which arises from other inflammations, with this exception that where no adhesions of the sides of the vein are formed, or where such adhesions are incomplete, pus passing into the circulation may add to the general disorder and even render it fatal." (p. 26.) And, having seen inflammation propagated along the jugular vein of horses into their chest, and followed by death, HUNTER says:—"But what is the particular circumstance which occasions their death I have not been able to determine; it may either be, that the inflammation extends itself to the heart, or that the matter secreted from the inside of the vein, passes along that tube in considerable quantity to the heart, and mixes with the blood." (p. 25.) This suggestion of HUNTER'S was, without having seen a case, converted by ABERNETHY (*b*) into an actuality, when he ascribes the great sympathetic fever occuring in an extensively inflamed vein, not simply to the inflammatory excitement, but also "because irritation will be continued along the membranous lining of the vein to the heart." HODGSON (*c*) copies this statement of ABERNETHY'S; for, in the single case of inflamed vein which he gives, he says distinctly, that "the vena cava superior was healthy. The diseased appearances were not gradually lost, but terminated abruptly; the heart was healthy;" whilst "the external jugular and the subclavian veins were filled with pus, and when slit open were found to be much thickened and lined with lymph." (p. 314.) He considers that "the constitutional irritation which is accompanied with symptoms of greater debility than acute inflammation in general, may probably arise from the extent of the inflamed surface, but that it is not unlikely it may be an effect produced upon the nervous system by the pus which is secreted into the vessel being mixed with the circulating blood." (p. 318.) CARMICHAEL (*d*) holds that the symptoms presented in phlebitis "were no doubt owing to the formation of

(*a*) Observations on the Inflammation of the Internal Coats of Veins; in Transactions of a Society for the Improvement of Medical and Surgical Knowledge, vol. i. London, 1793. 8vo.

(*b*) On the constitutional Consequences of Vaccination; in his Surgical Works, vol. ii.

(*c*) As above.

(*d*) Observations on Varix and Varicose Inflammations; in Transactions of the King's and Queen's College of Physicians in Ireland, vol. ii. Dublin, 1813. 8vo.

matter, and the influence which it must produce on the general system when mixed with the mass of blood." (p. 368.) And BOUILLAUD (*a*) also ascribes the typhoid symptoms to the presence of pus in the system. TRAVERS (*b*), however, does not agree with these writers as to the existence of pus being the cause of the symptoms. He first distinguishes between the inflammation which terminates in the formation of pus, and that which terminates in depositing adhesive matter or lymph, extends to the trunks of the system, and sometimes, it is said, reaching the heart: the former condition is a protracted irritation, causing hectic and ending in exhaustion; the latter a typhoid fever which, speedily producing delirium, terminates within a few days: cases of the first kind, though always dangerous, sometimes recover, but of the second, he believes, never. He then proceeds:—"There have been many conjectures respecting the cause of the fatal termination of these cases, at which I confess I feel surprised; among others, the inflammations, by extension, of the heart or the membranes of the brain and the conveyance of pus into the circulation have been mentioned. Not to insist on the innocuous quality of pus, it should be observed, that the most rapidly destructive inflammation is that which has the true adhesive progress, in which no pus is secreted. But, if we consider the importance of the veins in the economy, the extent of surface which the collective areæ of the venous trunks afford, larger, I imagine, than any of the shut sacs of the body, and the diffused and disorganizing character of the inflammation, we can surely be at no loss to account for the disturbance of the system. It is an error to suppose that any quicker sympathy exists between the constitution and the venous, than the arterial or absorbent system. I say this because I have observed something like that superstitious alarm which is excited by events that we do not expect, and cannot explain, has been produced by the fatal catalogue of tied veins, and a comparison of this with the generally successful cases of tied arteries. All the mystery of veins is, as I have attempted to show, that they are indisposed to inflame, but, when excited, inflame by continuity; and therefore it is that the constitution sympathises so deeply." (p. 286.) In a very excellent paper on phlebitis, ARNOTT (*c*) deduces from the collation of cases "the total disproval of the assertion, that death results from the extension of the inflammation of the vein to the heart." In none of the ten instances following venesection was the superior cava affected, much less the heart; and, in half this number, inflammation had not reached to the subclavian or even to the axillary vein. In the cases where the inferior cava had become inflamed, the first is the only one in which the heart is represented to have been actually implicated; and here, the deposition of lymph terminating at the entrance of the emulgent vein, the observation is, that there were marks of diffused inflammation extending to the right auricle of the heart, but the signs of adhesive inflammation terminated as above." * * * With the exception of the instance just alluded to, I have only found two others in which it is alleged that the inflammation had extended from the vein to the heart, and in these the description is not very precise. Both cases are mentioned by RIBES (*d*). In one, occurring so far back as the year 1799, where the veins of the arm were inflamed in connexion with gangrene of the hand from chilblain, "traces of inflammation" are stated to have been continued into the superior cava, and even to the interior of the right auricle and ventricle; and, in the other instance, where the saphena evinced some signs of inflammation, in a case of mortification of the leg and foot, it is stated, in the same vague terms, that "the right auricle and ventricle of the heart, as well as the inferior cava at its insertion into this organ, had manifest traces of recent inflammation." It is to be regretted that RIBES has not distinctly specified what the "traces" were which he considered as indicative of inflammation in the lining membrane of the heart. (p. 42, 43.) From ARNOTT's statement, it appears further that "there are considerable differences in the extent of vein occupied by inflammation in fatal cases of phlebitis. Sometimes the disease has spread into several or most of the veins of a limb from that primarily affected; at others it has not proceeded beyond the vessel in which it originally appeared," sometimes is "limited to a few inches only of a vein," and thus "justifies the inference that the dangerous consequences from phlebitis bear no direct relation to the extent of the vein which is inflamed." (p. 44.) As regards the contents of the inflamed vessels, "in a number of them, where an open wound existed in the vein, pus was discharged from it during life; whilst in fourteen cases out of seventeen, pus, or pus in conjunction with lymph, was present in the vessel after death.

(*a*) Recherches Cliniques pour servir à l'Histoire de la Phlébite: in Revue Médicale, June, 1824.

(*b*) Essay on Wounds and Ligatures of Veins; in COOPER and TRAVERS's Surgical Essays, vol. i. 3d Edition. London, 1818. 8vo.

(*c*) A Pathological Inquiry into the Secondary Effects of Inflammation of the Veins; in Medico-Chirurg. Trans., vol. xv. 1829.

(*d*) Revue Médicale for July, 1825.

In two instances, no mention is made of pus, the contents of the veins being described in the one as "adhesive matter," in the other, where the cava was concerned, as "flakes of lymph." In one case only, where the inflammation occurred in a vein previously diseased, or in a vein, the branches of which at least were varicose, neither pus nor lymph was found in the vessel. "It results from this statement, that, although pus is present in the great majority of fatal cases of phlebitis, and that, although it should appear from the character of the general symptoms, and the effects produced upon animals by the injection of a similar fluid into their vessels, the passage of pus into the circulation is probably the principal, yet the circumstances do not justify us in regarding it as the sole cause of the secondary affection. In addition to the presumed absence of pus in two instances, and its declared absence in a third, it may be remarked that the early appearance of the symptoms in some cases seems scarcely to correspond with the time usually required for the production of pus, as in one which occurred to FREER, (quoted by HODGSON, p. 551,) where they came on suddenly, four hours after ligature of the saphena." (pp. 44, 45.)

"The secondary affection in phlebitis usually shows itself in from two to ten or twelve days after the receipt of the injury which has occasioned the inflammation in the vein; where the vessel has been previously diseased, sometimes sooner. * * * The duration of this affection offers some variety," (pp. 51, 53,) death taking place at different periods from the fourth day to the end of the seventh week. The remarkable morbid appearances recited by ARNOTT are, "in the chest, effusions of sero-purulent fluid into the cavities of the pleura and pericardium, exudation of coagulable lymph on the surfaces of the heart and lungs, hepatisation of the latter organ, infiltration of pus into its tissue, or small collections like a mixture of pus and lymph, pus also in the muscular substance of the heart. * * * In the cellular substance, intermuscular as well as subcutaneous, pus and sero-purulent fluid have been extensively deposited, sometimes in collections like abscesses, at others, appearing more like an effusion into its cells than as resulting from the common process of inflammation. These collections more frequently occur in the vicinity of joints. * * * In the joints, a most violent inflammation of the synovial membrane, its distension with purulent matter, destruction of the cartilage and baring of the bones. * * * In the eye, opacity of the cornea, injection of its blood-vessels, and destructive changes in its humours or its coats. Besides these affections, there were found in five instances within the cranium opacity and thickening of the tunica arachnoides, effusion between it and the pia mater, and increased secretion into the ventricles. In nine the head was not examined, and in three no morbid appearances were noticed." (pp. 53, 57.) The conclusion at which ARNOTT arives is, "that death in cases of phlebitis does not take place from the inflammation extending to the heart; whilst the history and character of the symptoms which precede this event, the very small portion of vein which is sometimes found to have been inflamed, and the general presence of pus in its cavity, all tend to establish, that the entrance of this fluid into the circulation is the principal cause of the alarming and fatal consequences of phlebitis, a similar influence being perhaps also possessed by any inflammatory secretion from the vein." (p. 61.)

On the inflammation of the femoral and iliac veins, which occurs in puerperal women, which sometimes, but not always, gives rise to *Phlegmasia dolens*, Dr. ROBERT LEE (*a*) observes, that, "whether the inflammation of the coats of the veins be simple adhesive inflammation, or inflammation of a specific kind connected with the puerperal state, and differing, not only in the degree of intensity, but in its essential nature from phlebitis after venesection, it is difficult to determine. The peculiar character of the symptoms seems strongly to favour the latter opinion, though it cannot be denied that the disease occasionally assumes the form of common phlebitis, fatal cases having occurred where pus has been found secreted by the internal coats of the iliac veins, and death caused by inflammation and apostematous deposits of matter in the lungs and other remote organs of the body." (p. 145.)]

In the *Absorbent Vessels*, inflammation arises either from external injuries and so on, or from some morbid matter which they have taken up. It is indicated by painful red swelling of the absorbent vessels up to the nearest gland. It usually terminates in resolution.

[Inflammation of the absorbent vessels may arise without either injury or the absorption of morbid matter, but simply from irritation, as frequently seen in whitlow or other inflamed condition of the fingers or toes, as when they have been chafed or after the

(*a*) On the Pathology of Phlegmasia dolens; in Medico-Chirurg. Trans. vol. xv. 1829.

application of a blister. The red streak or streaks which indicate the inflamed absorbent vessel or vessels, is generally little thicker than a stout thread, pale towards its edges, can at first scarcely be called a swelling, but is more like a streak of paint on the skin, and only after some time has a slightly knotted feel. It runs along the limb with great rapidity, and will in the course of a few hours enter the cavities of the trunk. It terminates in suppuration less frequently and less quickly than inflammation of the veins. Generally it subsides as the irritation which has excited it is relieved, and I do not remember to have observed continuance of the cordlike feel long after the inflammation has ceased —J. F. S.

In reference to these red streaks, HUNTER observes:—"These reddish streaks are supposed to be absorbents, becoming inflamed by their carrying a stimulating fluid. I am apt to suppose them to be absorbents; but I do not conceive that this effect arises from absorption. If it arose from such a cause, it should be uniform; the cause should always exist when the effect takes place. It is first to be observed that it only takes place in certain constitutions, in which absorption one way or other explains nothing; and I find upon observation that this effect shall be coeval with the inflammation where no suppuration has taken place. I have even seen it arise from accident, prior to the possibility of inflammation taking place, viz., in the time of the pain arising from the immediate effects of the accident; this was in the finger, from the prick of a clean needle, which had been for some time pricking new buckskin leather; the glands in the arm-pit were sore, sickness attended with its usual symptoms, such as oppression, was nearly immediate. Its direction from the source of the circulation is another strong proof of its not arising from absorption, and its taking place at some distance is also a corroboration of the same opinion. Another strong circumstance in favour of this opinion is, that the morbid poisons do not produce this effect where we know absorption has taken place. Thus the venereal seldom or never produces it." (p. 275.)

I have seen earthy deposits in the absorbent vessels of the skin, and also of the spermatic cord, giving them the appearance of corallines.—J. F. S.]

Inflammation of *Nerves* or rather of their sheaths is no very rare circumstance. As the nerves have but few nutritive vessels, the usual symptoms of inflammation, viz., heat, redness, and swelling, are present only in a slight degree. It begins with formication, torpor, frequently with severe darting pain, which spreads in paroxysms, like electric shocks, along the branches of the nerves; and to these are added febrile excitement, cramps, and convulsions. The inflammation may have either a *chronic* or *acute* course; the former we observe in *ischias nervosa* and many neuralgies, the latter in *tetanus*, *hydrophobia*, and so on. On examination we find the nervous sheaths especially affected, reddened, swollen; the nervous matter is frequently dissolved, as if grangrenous; often there are produced exudations in the nervous sheaths, or degeneration of the nerves.

Inflammation in the *Bones* occurs either in the periosteum or in the medullary membrane, or in the substance of the bone itself. In all these cases the symptoms are different, especially according to the acute or chronic course of the inflammation. In inflammation of the *Periosteum*, (*Periostitis*,) a circumscribed swelling with more or less acute pain is produced by exudation between the bone and the periosteum. If the inflammation do not resolve, it runs on to hardening, gouty thickening, exostosis, into caries, necrosis, and more rarely into fungous degeneration. Inflammation of the *Medullary Membrane* is characterized by deep-seated, gnawing pain, at last the bone itself swells throughout its whole thickness; and, if the inflammation do not resolve, it runs on to closing up of the medullary canal, or suppuration and destruction of the bone from within outwards, in necrosis or fungous degeneration. In inflammation of the *Bone* itself thickening throughout its whole extent *(Hypertrophy)* may occur, with closing of the medullary hole, ulceration, necrosis, and different kinds of degeneration of the bony tissue.

42. The *Prognosis* of inflammation is very various; it depends specially on its severity and character, on its causes, on the constitution of the subject, and on the parts in which it is situated.

43. The *Treatment* of inflammation generally purposes to effect its resolution, except in certain critical inflammations, in wounds with much contusion, and in furuncles.

The first indication is the removal of the cause, if it continue to operate. If the inflammation be not very great, this alone is often sufficient. If the cause cannot be removed, or the inflammation have advanced to a certain extent, the plan of treatment includes all the means which are implied in the term antiphlogistic mode of cure. In those inflammations which are connected with much fever we must employ bleeding, nitrate of potash, and other antiphlogistic remedies, with cooling diet and rest. If the inflammatory symptoms are thereby diminished, calomel is specially useful to hasten the absorption of the lymph effused into the cellular tissue, and to prevent its coagulation. If the inflammation have an erethitic character, if it be accompanied with greatly increased sensibility, we endeavour after the above-mentioned antiphlogistic treatment to lessen it by opium in connexion with proper antiphlogistic means, such as mercury, hyoscyamus, and hydrocyanic acid, laurel water, and so on. If gastric impurities exist, they must be removed by vomiting and purging. In malignant inflammation the treatment must particularly depend on the kind of accompanying fever; the antiphlogistic treatment is then to be used only with circumspection. If the inflammation have a specific character, if it be connected with a dyscratic affection, we must act according to the degree of the inflammatory reaction, first on the antiphlogistic plan and then against the dyscracy: the antiphlogistic treatment, however, in this case, requires to be pursued with moderation.

[John Hunter, in treating "of the methods of resolution by constitutional means," makes many very excellent remarks on blood-letting, the object of which, as just mentioned, is to produce the contraction of the vessels, and which is always to go "hand in hand" with the soothing or lessening irritability, or the action of dilatation, by means of sedatives, relaxants, and stimulants, sudorifics, &c. Neither of these proceedings "can possibly lessen the original inflammatory disposition:" they may, however, "in some sense be reckoned direct; for, whatever will produce the action of contraction in the vessels, is counteracting the action of the dilatation. Lessening the power of action belonging to any disposition can only lessen or protract the effects, which, however will be of singular service, as less mischief will be done, and it will often give the disposition time to wear itself out. Means employed on this principle, should be such as give the feel of weakness to the constitution; which will affect the part, and will make the vessels contract; but this practice should not be carried so far as to produce the sense of too much weakness, for then the heart acts with great force and the arteries dilate. Bleeding, then, as a general principle, is to be put in practice: but this must be done with judgment; for I conceive the effects of bleeding to be very extensive. Besides the loss of any quantity of blood being felt, in proportion to the quantity lost, an universal alarm is excited, and a greater contraction of the vessels ensues, than simply in proportion to this quantity, in consequence as it would appear of a sympathetic affection with the part bleeding.

"As many patients that seem to require bleeding have been already bled, it may not be improper to inquire how they bear or are affected by bleeding; for, certainly, all constitutions (independently of every other circumstance) do not bear this evacuation equally, and it is probable, that its effects on inflammation may be nearly in the same proportion; if so, it becomes a very useful caution; for, although the loss of blood may as a general principle be set down as a weakener, and probably the greatest, as we can kill by such means, yet the loss of certain quantities in many constitutions is necessary for health; this is either when there is a disposition to make too much blood, or a constitution that cannot bear the usual quantity; in such, when

known, bleeding with freedom is certainly necessary. * * * * * * Every part of the body under inflammation will not bear bleeding alike. I believe that the constitution bears bleeding best when the inflammation is in parts not vital, and those near the source of the circulation: whatever disturbs some of the vital parts, depresses, but not equally in all; and in them it becomes more necessary to be particular, for, in accidents of the brain, bleeding freely, even so as to produce sickness and fainting, is necessary. It is probable that the sickness attending such accidents, is designed to lessen the influx to the head, and occasion the vessels of the brain to contract." (pp. 335, 7.)

"With regard to this evacuation," (blood-letting,) he observes further, "it is worthy of particular consideration, whether or not in all cases, where it can be put in practice, bleeding in or near the part will answer better than taking the blood from the general habit; for certainly less may be removed in this way, so as to have equal effect upon the part inflamed, (and probably upon every disease that is relieved by bleeding,) and yet affect the constitution less; for, although, in many cases, the general habit may be relieved by bleeding, yet the part affected, where it can act, will in all cases require this evacuation most, and local bleeding will keep nearer these proportions, whereas taking blood from the general system is just the reverse. * * * I have observed that there is something similar to sympathetic affection in bleeding. I conceive that all the sympathetic powers, the universal, continued and contiguous, may be brought into action from the local influence of bleeding. Thus, bleeding in the part inflamed, I can conceive, does more than simply emptying the vessels mechanically, for that would soon be restored from the general circulation; but it acts by continued sympathy, viz., the vessels of the part being opened, they contract for their own defence, and this is carried further among the vessels of the part; so that bleeding from the part acts in two ways, viz., mechanically by relieving the vessels of some blood, so as to allow them to contract in proportion as the load is taken off, and also to excite them to contraction in order to prevent the effusion of blood. I suppose, likewise, that contiguous sympathy comes into action; for this would appear from practice and observation to be a principle in bleeding: therefore, in inflammation of contiguous parts it is proper to bleed from the skin opposite to them." (pp. 338, 9.)

"Where the first indication for bleeding takes place, viz., where there is violent inflammation, with strength of constitution, bleeding freely will be of singular service. * * * As it seldom happens that bleeding once will be sufficient in a considerable inflammation, the first or preceding blood taken becomes a symptom of the disease. * * * On the other hand, there may be indications for bleeding sparingly; first, when there is too much action with weakened powers; secondly, when there is a disposition to form but little blood; thirdly, when the part affected is far from the source of the circulation. From the above three dispositions that require bleeding sparingly or with caution, I may observe, that it will most probably be proper in all such cases to bleed from, or as near, the part affected as possible, in order to have the greatest effect with the loss of the least quantity of blood, more so than when the constitution is strong, because the constitution in such cases should feel the loss of blood as little as possible. * * * But in many cases the blood cannot be taken away from the part itself, but only from some neighbouring part, so as to affect the part inflamed." (pp. 339, 40.)

"Bleeding should in all cases be performed with great caution, more particularly at first; and no more taken than appears to be really necessary; it should only be done to ease the constitution, or the part, and rather lower it where the constitution can bear it; but, if the constitution is already below or brought below a certain point, or gives the signs of it from the situation of the disease, then an irritable habit takes place, which is an increased disposition to act without the power to act with. This of itself becomes a cause of the continuance of the original disposition, and therefore will admit neither of resolution nor suppuration, but continue in a state of inflammation, which is a much worse disease than the former." (p. 344.)

44. Different as is the *General* treatment of Inflammation, no less so is the *Local*. The local means are, *abstraction of blood*, *cold*, *moist*, *or dry warmth*, *salves* and *plasters*, *astringent*, *anodyne* and *derivative means*.

["Wherever," says JOHN HUNTER, "there has been a violence committed, or some violent action is going on, there is a greater influx of blood to that part. Lessening therefore that influx becomes one mode of relief; for, as the vessels dilate, they should not be encouraged in that action. Although the increased influx is to be considered chiefly as an effect, yet it is to be considered as a secondary cause; and, from our ignorance of the immediate cause, it is probably only through such secondary causes that

we can produce any effect; and upon these principles most likely rests, in some measure, the method of resolution; for, whatever will lessen the power and disposition will also lessen the effect; and possibly these will likewise lessen the force of the circulation. If the inflammation is attended with considerable action and power, as it were increasing itself, then the modes of resolution are to be put in practice; the one by producing a contraction of the vessels, the other by soothing or lessening irritability, or the action of dilatation. The first, or contraction of the vessels, is produced in two ways; one by producing weakness, for weakness excites the action of contraction of the vessels; the other by such applications as induce the vessels to contract." (p. 335.)]

45. *Local Bleeding* is more indicated as the inflammation is more simple and active, the redness and swelling greater. Every local blood-letting is connected with a certain degree of irritation which may at once reproduce an increased influx of blood. This is the more certain when general plethora is present. It is therefore necessary in many cases to employ general previously to local bleeding. Local blood-letting is performed by *leeches*, *scarifications*, and *cupping-glasses*. Leeches are most commonly employed; scarifications are restricted to those cases in which the application of leeches is not possible, as, in the mouth, on the tongue, in the throat, on the conjunctiva. Cupping is more especially suited to lingering and deep-seated inflammations, inasmuch as, besides the abstraction of blood, it also operates as a powerful derivative on the surface.

46. The employment of *cold* by the overlaying of cloths dipped in cold water, in water and vinegar, in water cooled by the solution of different salts, in solutions of acetate of lead or sulphate of zinc, the application of ice and snow, is only indicated at the commencent of idiopathic inflammation, when but little swelling has taken place. These means must always be preserved at the same degree of cold. They are specially active in inflammations caused by severe bruises, lacerations, and so on, when there is accompanying weakness of the vessels, and their effect may then be still more increased by the addition of spirituous remedies; for example, brandy, THEDEN'S arquebusade, and so on.

[In using ice or freezing mixtures, care must be taken, lest, by their too long continuance, the vitality of the part is destroyed, and sloughing of the skin produced, which has occasionally happened.—J.F.S.]

47. *Moist warm remedies* are employed in shape of fomentations and poultices, which are made of mucilaginous or mealy substances, from linseed-meal, bread crumbs, oatmeal, bran, marshmallow leaves, emollient herbs boiled with water or milk put into linen bags and laid in such way as at once to cover the whole neighbourhood of the inflamed part. Poultices are preferable to fomentations, as their warmth is retained longer, and they need less frequent renewal. Fomentations are therefore only employed in cases where the part is so sensitive that it cannot bear the pressure of the poultice; they must also extend over the whole neighbourhood of the inflamed part, and be covered with a dry towel or flannel by which the heat is longer retained. These remedies are especially applicable to large swellings and painful tensions, as, by their relaxing properties, they diminish the resistance of the cellular tissue. If the tension be less, the poultice may be moistened with lead wash. Many inflammations, as gouty and erysipelatous, do not consort with the employment of moist remedies, but only with *dry warmth*. When the pain is very severe, narcotics, as the fresh hyoscyamus, belladonna, and so on, may be added to the poultices. With these moist warm remedies are usually also employed the

infriction of emollient salves, especially mercurial ointment, in order to further resolution by hastening the absorption.

[" Fomentations, or steams, washes, and poultices," says HUNTER, "are the common applications to a part in the state of inflammation. The first and last are commonly applied to inflammation arising from external violence and proceeding to suppuration; the second commonly to internal surfaces, as the mouth, nose, urethra, vagina, rectum, &c. The action of the first two is but of short duration.

"Fomentations and steams are fluid bodies raised into vapour: they may be either simple or compound; simple, as steam or vapour of water, compound as steam of water impregnated with medicine. * * * * Washes are in general fluid applications, and are more commonly applied to inflammations of internal surfaces, than of the common integuments: there are washes to the eye, called collyria; washes to the mouth and throat, called gargles; washes to the urethra, called injections, and to the rectum, called clysters. * * * These applications, like fomentations, are of short duration, for there is no possibility of applying these powers constantly, except in the form of a poultice, whose operation is somewhat similar, and indeed they are only substitutes for a poultice, where that mode of application cannot be made use of, as I observed with respect to internal surfaces.

"Poultices are constant applications, and like fomentations may be of two kinds, either simply warm and wet or medicated. The greatest effect that a poultice can produce must be immediate; but its power will extend beyond the surface of contact, although only in a secondary degree.

"To the common inflammation, the simplest poultice is supposed to be the best, and that effect I believe is only by keeping the parts easier under the complaint; but I am of opinion that such do not affect the inflammation any other way. A common poultice is, perhaps one of the best applications when we mean to do nothing but to allow nature to perform the cure with much as ease to herself as possible. Poultices may be medicated so as to be adapted to the kind of inflammation." (pp. 361, 362.)

ABERNETHY'S observation that "poultices are blessings or curses as they are well or ill made, and that more commonly they only irritate instead of doing good," though it may excite a smile, is borne out by daily observation; for, instead of the highly sensitive surface of an inflamed part being soothed, as it should be by the application of a poultice, "the three properties of which are," to use that excellent teacher's words, "that it should be perfectly soft, perfectly smooth, and perfectly moist," it is too frequently irritated by loading with a heap of hard and lumpy materials which soon dry, and almost as soon become sour.

The *bread and water poultice* is the best, and in general most suited for all circumstances, either as a simple application, or as a vehicle for the employment of the juices of substances which in themselves are too harsh to be applied to very sensitive parts. To make this poultice, ABERNETHY directs:—"Scald out a basin (for you can never make a good poultice unless you have perfectly boiling water) and put boiling water in it; throw in some coarsely crumbled bread crumbs, and cover it up with a plate. When as much water has been soaked up as the bread will imbibe, drain off the rest, and a light pulp (not to be beaten into paste, as usually done, but merely broken with the edge of a fork) is then left, which is to be spread, the third of an inch thick, on folded linen, and applied at the temperature of a warm bath." If it be advisable to medicate the poultice, the juice of fresh hemlock, decoction of carrot, or opium, or any other material in solution, may be added to the sodden bread after it has been well drained; and thus is formed a very soothing application. It is best not to add lard or grease of any kind to a bread poultice, as thereby its relaxing effect on the skin is diminished or destroyed. But as, if left exposed to the air, it soon cools, dries, gets hard, and becomes uncomfortable and irritating, it must be either continually moistened by dropping on it, from a sponge, warm water or the warm medicated solution through the linen, without removing it from the part to which it is applied, and under which circumstances it acts to a certain extent by evaporation, diminishing the increased external heat, and lessening the action of the vessels, though the warmth of the water prevents its reduction to coldness. But, if suppuration have set in and it is necessary to keep up the warmth, then the cloth containing the poultice must be enveloped in a piece of oiled silk, which retains the moisture, and be overlapped with flannel, which preserves the warmth. Milk is often used instead of water for making poultices; but, if the skin be unbroken, water is preferable. No poultice should be boiled, as it is merely converted into paste.

The *linseed-meal poultice* is to be made like the former, by throwing the meal into perfectly boiling water; but it requires well beating to remove all the lumps, and is then to be spread a quarter of an inch thick on linen. It is not a good application for

inflamed parts on account of its weight, and, indeeed, under any circumstances, it is best if made with an equal quantity of bread crumbs.—*MS. Notes of Lectures.*

In cases where warmth is most agreeable to the patient's feelings, and in which fomentations are employed, either because thin flannel dipped in them is lighter than the poultice, or because the surface to be covered is so large that a flannel is most convenient, the moisture and warmth are easily preserved by enveloping the overlaying flannel with oiled silk; this treatment has also the advantage of not so repeatedly disturbing the patient as the flannels alone do.—J. F. S.]

48. In the *Torpid* inflammation this character may show itself from the first or during its progress: when the expansion is more passive, and the vessels over distended, with diminished reaction, the congestion of the vessels must first be relieved by local blood-letting, and then the vital activity must be aroused by exciting remedies; by the momentary use of cold, by overlaying with watery or vinous infusions of aromatic herbs, by warm applications of lead wash or THEDEN'S arquebusade, by infriction of volatile salves, of mercurial ointment with camphor, by the application of irritating plaisters, of ammoniacum plaister, which we specially use at night, because the applications very readily cool. With these local remedies a corresponding general treatment according to circumstances must be coupled.

The local and general use of stimulating and irritating remedies in many cases of inflammation is not contradictory to the above-mentioned conditions, and does not mislead to the recognition of the so-called *asthenic inflammations.* There is no inflammation depending on weakness; certain states of disease may, however, co-exist with inflammation, or be produced by the consumption of vital activity, caused by the inflammation, by the removal of which alone a cure of the inflammation is possible.

49. The *derivative remedies* are founded on the law of reciprocal action in our constitution; by which means an existing irritation may be lessened or removed by a more severe one. To this class belong blisters, setons, issues, and the rubbing-in of irritating salves. In general these are only to be used when the severity of the inflammation has been moderated by the preceding treatment; they are particularly useful in chronic inflammation.

In how far this general mode of treating inflammation must be modified according to the difference of the structure affected, will be subsequently considered in many places.

[" Derivation" says HUNTER, " means a cessation of action in one part, in consequence of an action having taken place in another: and when this is a cessation of a diseased action, then a cure of that action in the original part may be said to be performed: this cure was brought into use from the idea of humors; that is, the drawing off of the humors from the seat where they had taken possession: but I believe much more has been ascribed to it than it deserves. How far it really takes place, I have not been able fully to ascertain in all its parts; that is, how far the real disease has been invited, and accepts of the invitation: but I have already observed that there is such a principle of disease in the animal economy, although we must see from derivation, that the same quantity or perhaps more irritation is retained in the constitution; yet the artificial irritation produced being either such as more readily admits of a cure than the diseased part, or being in parts which are not so essential to life, an advantage by this means is gained." (p. 359.)]

50. If the inflammation have a disposition to recede, every thing must be removed from the inflamed part which can disturb the proper development of the inflammation and favour its recession. The inflamed part must be covered with warm flannel, it must be protected from the approach of the air, and medicines given internally which will act on the skin. If the inflammation have already subsided from the external surface, we must

endeavour to bring it back by mustard plasters, blisters, and cauteries; it must be treated generally according to the severity and character of the inflammation.

51. If the inflammation have run on to exudation, and inflammatory symptoms still remain, antiphlogistic neutral salts must be employed, especially bitartrate of potash; but, if accompanied with weakness and inactivity of the absorbents, then exciting remedies and such as act upon the kidneys must be used, as mercury, squills, digitalis, senega, and so on. If the accumulation be so great that it interferes with the active functions of important viscera, or cannot be removed by the methods already proposed, the fluid must be discharged by opening the cavity in which it is contained. In œdematous swelling of the cellular tissue, bags of warm aromatic herbs, mingled with camphor, must be used; in torpid subjects, flannel fumigated with mastic and amber, and a moderate compression by means of bandages may be employed.

52. If the symptoms described (*par.* 10) indicate a transition of the inflammation to suppuration, nature must be assisted in this process. In strong persons, and with a certain degree of inflammation, suppuration in general is effected without difficulty, and it is sufficient to employ a less active general treatment, emollient fomentations and poultices. If the pain be more severe, narcotic poultices may be used; and, in decided hardness and inflammation, even blood-letting. But if, on account of the weakness of the constitution, or the torpid character of the inflammation, the formation of pus is tedious, it must be assisted by stimulating remedies; roasted onions, yeast, must be mixed with the poultices and applied warm. The diseased parts must be covered with rye flour and honey, with *emplast. de cicutâ c. ammoniaco, emp. galb., emp. diachylon comp.* All these, however, may be dispensed with by the suitable and constant application of warm lotions and poultices.

53. When under this treatment of abscess its *ripening* has taken place, that is, if about its circumference hardness is no longer to be felt, it either opens of itself or it must be opened. Only in small abscesses just beneath the skin, and in those in glandular structures, may the opening be left to nature (1). The early opening of abscesses is not unfrequently required, and specially under the following circumstances: 1. if in sensitive parts severe pain arises from the collection of pus, and the tissue of the part is thereby rendered tough and unyielding; 2. if the pus be collected beneath muscles and firm aponeuroses, in which case its burrowing is to be dreaded; 3. in abscesses in the neighbourhood of important organs surrounded with loose cellular tissue; for instance, abscesses in the neighbourhood of the rectum, or in the neck, where the pus may spread to the collar-bones; 4. in abscesses on the joints, or in the neighbourhood of other cavities, where, however, bursting into these cavities is not so much to be feared as the symptoms resulting from the pressure of the pus; 5. if the suppuration be near a bone or a tendon; 6. if by long continuance of the inflammation the cellular tissue beneath the skin be destroyed to a considerable extent; 7. and in critical abscess.

Abscesses in the neighbourhood of important parts are generally opened rather late, because in a large collection of pus the elevation of the skin ensures against any injury to deep-seated parts.

[(1) This is not good practice; abscesses just beneath the skin should always be punctured early, as otherwise there is great risk of sloughing of the integument and

the formation of an ugly scar. Neither should abscesses in glands be left to burst, which is often a very tedious process, as the capsule of the gland does not readily ulcerate, and will not till the whole, or nearly the whole, gland is destroyed; a large cavity is thus formed, which is generally very difficult to heal, as it assumes oftentimes a fistulous character. It is therefore always best to puncture a glandular abscess as soon as the capsule and the skin have become adherent, and the angry appearance of the latter indicates its disposition to ulcerate. But it is not unfrequently advisable to open such abscesses before the skin reddens, or even before it is adherent; for, in scrofulous and chronic abscesses, there is often little and sometimes no redness of the skin, and yet, the collection of pus increasing, the skin becomes stretched beyond endurance, and sloughing ensues.—J. F. S.]

54. The *opening of abscesses (Oncotomia)* is effected either by a *cutting instrument*, by *escharotics*, or by *seton*. That point is preferred for opening where the fluctuation is most distinct and the skin thinnest; but, if the skin is everywhere equally thin, then the lowest part is preferred. The size of the opening depends on the extent of the abscess, and should always be such that the pus will flow without hinderance. An aperture of five to eight lines long is generally sufficient; an opening of an inch and a half must be the extreme for an abscess of large size. It must be recollected, however, that the skin, distended by the pus, will contract after its evacuation, and thereby the aperture will be rendered smaller than was intended.

55. The *cutting instrument* is used in the following manner: the blade of the *lancet* being held with the finger and thumb of the right hand, sufficiently far from the point to permit of its entrance into the cavity of the abscess, and the skin covering the abscess being stretched by the fingers of the left hand, the lancet is to be thrust perpendicularly or obliquely in till the pus, oozing up by its sides, shows that the cavity of the abscess has been opened; and the aperture is to be increased to a proper size by raising the point of the lancet as it is withdrawn.

If the abscess be deep and the coverings thick, it should be opened with a *bistoury*, which, being held like a pen, is to be thrust into the abscess in the direction of the muscular fibres, and the opening is to be enlarged on bringing it out. If the abscess be very deep, and in the neighbourhood of important parts, it is most advisable to divide the parts covering it by repeated cuts, and with the fore finger of the left hand to feel in the wound at which point the fluctuation is most perceptible. This precaution is specially to be recommended in deep abscesses of the coverings of the belly and chest.

After opening an abscess the pus must be allowed to flow out gradually of itself, or it may be assisted by gentle pressure; everything which can interfere with its escape must be avoided, the aperture of the abscesses should not by any means be stopped up, but only covered lightly with charpie and a warm moist poultice, or merely with the latter.

[Pressing and squeezing abscesses, for the purpose of emptying after they have been punctured cannot be too much deprecated. Unnecessary pain is inflicted on the patient by the rough handling, which bruises the distended and still inflamed walls of the abscess. One object in making the puncture is to relieve the tension of the adjacent parts, and the escape of a very small quantity of pus immediately effects this. But the abscess empties itself sufficiently quickly by the simple contractibility of the skin, which gently presses out the fluid contents with little or no pain to the patient.

It not unfrequently happens that if the walls of the abscess be thick, the clean cut edges of the puncture are found adherent, and the aperture closed within twenty-four hours. The adhesions, however, are easily broken through, and the opening re-established by a little gentle pressure on the abscess. But I think it preferable, after making

the puncture, to introduce between the lips of the wound a very small portion of lint, with a long end hanging out: this is to be removed when the first poultice is replaced a few hours after making the puncture, which by that time is sufficiently established.—J. F. S.]

56. *Escharotics* are employed in the following manner: a piece of linen spread with sticking plaster, and in which a properly shaped hole has been cut, is to be so laid upon the abscess that the aperture should correspond with the point where it is intended to be emptied. The hole in the plaister is then to be filled with bruised and moistened caustic, and covered with sticking plaster. After six or eight hours the plaister is to be removed, if the caustic have produced a good slough, or the walls of the abscess have been eaten through and the pus escaped. The slough is to be pierced with a lancet and the abscess emptied, or, if the emptying does not seem urgent, the slough may be allowed to separate, and then the lancet is to be introduced. The pus is to be discharged by moderate pressure in an unbroken stream, the aperture to be covered with sticking plaster and a bandage applied. The walls of the abscess frequently at once unite, but most commonly a smaller quantity of pus collects, the emptying of which is to be performed by a second puncture, and the union furthered by a compressing bandage.

57. In passing a *seton* through an abscess an aperture with a lancet is to be made at its upper part, through which a blunt probe, armed with a bundle of several cotton threads some yards long is to be passed to the very bottom of the abscess, till its extremity is felt against the skin. An assistant retains the probe in this situation, and the skin being rendered tense, a cut is made upon the probe, which is then to be drawn out and the seton introduced into the cavity of the abscess. This may be done with a seton needle, in which case the parts covering the abscess are to be raised into a fold and then transfixed with the needle. When the abscess is emptied, the opening is to be covered with charpie and sticking plaster, the seton thread fastened, the whole covered with a compress and supported with a proper bandage. A fresh portion of the thread is to be drawn in daily. When the suppuration has diminished the threads are to be withdrawn and the union of the walls promoted by regulated pressure. In many cases the seton may be removed in three or four days, if the walls of the abscess have acquired a sufficient degree of inflammation to unite by proper pressure.

58. In general the opening of abscesses with a cutting instrument is most preferable. The application of escharotics is accompanied with great pain; a part of the skin is always destroyed, in consequence of which a large scar remains. The seton is also painful and excites more or less severe inflammation. These modes of opening are therefore restricted to those cases in which it is desirable to excite a certain degree of inflammation, as will be presently mentioned in speaking of cold abscess. The employment of caustic in critical abscesses, in order to hasten and bring about their opening at an earlier period, may be conveniently replaced by the proper use of poultices, and the ordinary method of opening with the lancet.

[Puncturing abscesses is in all cases to be preferred. Escharotics are never permissible, as they produce a certain slough, the prevention of which is one object in emptying an abscess. The introduction of a seton is almost as objectionable; for the inflammation of the sac of the abscess which it excites will often be uncontrollable and hasten hectic fever.—J. F. S.]

59. The so-called *Cold Abscess* (Lymph-Abscess) resulting from lingering inflammation, (*par.* 15,) in which the covering skin is but little or not at all changed, may sometimes be dispersed by resolving poultices, infrictions, and plasters, by producing artificial wounds in the neighbourhood, by the application of the moxa, and so on, with simultaneous attention to the constitutional disorder. This, however, seldom happens, and since, after they have been opened in the way of ordinary abscesses, or have opened of themselves in consequence of the diminished vital activity of their walls, and the generally depressed state of the system, a very ill-conditioned and frequently fatal thin and copious suppuration sets in, special modes of proceeding in the treatment of these abscesses are therefore directed, in order partly to prevent the entrance of the air in opening them, partly to excite by the emptying of the swelling, such degree of inflammation as will produce their union, or the secretion of a good plastic pus, and then the cure is effected as in common abscess.

60. The modes of treatment to this end are, the emptying of the swelling with a lancet puncture or with a trochar, without admitting air, after which the opening is to be closed with sticking plaster, a moderately compressing bandage applied, and the opening frequently remade, till the union of the walls of the abscess has taken place (ABERNETHY;) opening with the lancet after the previous application of caustic (BEINL;) the introduction of a seton or a bundle of silk threads, to be withdrawn on the third or fourth day, and the cure then perfected by compression (WALTHER;) tapping with the trochar and injection of red wine, solution of bichloride of mercury, or of nitrate of silver (SCHAACK;) or of boiling hot water (RUST;) or a solution of fully neutralized nitrate of mercury (NASSE;) the laying open of the swelling longitudinally throughout half its length, and filling it with charpie moistened with solutions of caustic (ZANG;) and the removal of the skin from the whole extent of the swelling (CALLISEN.)

61. The variety of these modes of treatment proves, that neither of them separately taken is sufficient to meet our wishes. The choice of them must therefore be guided by the difference of constitution, by the more or less weak state of the cellular walls and by the size of the swelling. If the tumour be not be very large and the constitution of the patient still tolerably good, perfect closing of the cavity of the abscess may usually be produced by repeated puncture with the lancet or trochar, or at least it may be so much diminished that we may be able to effect a cure by laying it open with a bistoury, and filling it with charpie, moistened with irritating remedies, especially solution of nitrate of mercury. In swellings of larger size it is far preferable to make the opening with caustic, or by the introduction of a seton. If the cure be not in this way effected, and, if suppuration threatening exhaustion occur after artificial or spontaneous opening, it is proper to remove from the front wall of the swelling as much as may be allowable, or to fill the whole cavity with charpie, which, according to the various degrees of irritating, is to be moistened with a stronger or weaker solution of nitrate of silver, or nitrate of mercury, to bring about a good suppuration. I am, however, convinced, that by the employment of these violent modes of treatment, the very worst symptoms are often produced which are dreaded in the common mode of treating abscesses. At least, I have in very many cases of cold abscess made the opening at the proper spot in the usual

way with the lancet, and, without the use of any other local means than moist warm poultices, the cure has been effected more quickly and with less trouble than by other modes of treatment. The opinions relative to the treatment of this cold or lymphatic abscess are so various, doubtless because they are confounded with *congestive abscess* and with the swellings of mucous bags (*par.* 17.) Corresponding general means must be employed with the local treatment; we must use strengthening remedies bark, rhatany, sweet flag, with diluted acids, a strong nourishing diet, and attention must be paid to cleanliness and good air.

According to KLUGE (*a*), the lymph should be discharged by an incision, or, if that be not sufficient, the whole front wall of the swelling must be cut away, the opening of the hardened lymphatic vessel must be found, which is usually superficial and easily discernible by the trickling of the lymph; a bristle must be introduced into its open mouth, and then the vessel must be slit up for half an inch or an inch, until the healthy trunk is reached. The bristle is then to be removed, and either a compressing bandage applied, or, if there do not occur a proper degree of inflammation, the opened lymph-vessel must be touched along the part which has been slit open with a pointed piece of nitrate of silver up to the healthy portion, and then the compress applied.

Upon the subject of opening abscesses consult

ABERNETHY on Chronic and Lumbar Abscesses, in his Surgical Works, London, 1815, vol. ii. p. 153.

SCHAACK und MURSINNA, über de oft unzulängliche Hülfe bei lymphatischen Geschwülsten: in MURSINNA's Journal, vol. i. p. 2. 1800.

BEINL, A., von einer eigenen Art Lymphgeschwülst, und der zweckmässigsten Methode, die selbe zu heilen. Wien, 1801. In Abhandl. der med. chir. Josephin Akademie in Wien, vol. ii.

RUST, einige Reflexionen über die Natur und Heilung der Lymphgeschwülste, in HARLESS Jahrbüchern der teutschen Medicin und Chirurgie, vol. i. p. 155. And in RUST's Magazin, vol. i.

JACOPI, Operazioni e Sperienze fatti nel instituto clinico di Chirurgia di Pavia nel anno 1812, 1813, vol. ii.

CHELIUS, in neuen Chiron herausgegeben von TEXTOR, vol. i. part i.

VON WALTHER, über die wahre Natur der Lymphgeschwülste; in Journal für Chirurgie und Augenheilkunde, vol. i. p. 584.

62. The further treatment after opening an abscess must be quite simple; *we must endeavour to keep up merely a free undisturbed escape of pus, and to preserve a proper vital correspondence.* No further local treatment is required beyond the use of moist warm poultices. The edges of the opening draw together, the walls of the abscess approach and adhere, granulations (*Fleischwarzen*, Germ.) are produced from the bottom of the abscess by the development of fine vessels and delicate cellular tissue, which become more and more solid, are covered with a thin skin, and form a scar (*Cicatrix*, Lat.; *Narbe*, Germ.; *Cicatrice*, Fr.) A more active degree of inflammation, when continued or developed after the opening of the abscess, in consequence of which its edges swell, its neighbourhood becomes very sensitive, and the suppuration diminished, is usually consequent on improper treatment, on the use of tents and so on, and can only be relieved by the aforesaid treatment, which diminishes the irritation.

63. If a proper degree of vitality be wanting in weak constitutions or in abscesses in parts far distant from the heart; if the edges of the

(*a*) ZEMBSCH, as above.

abscess be flabby, insensible, discoloured; if a thin lymphatic sanious fluid be secreted; these are indications for the employment of more or less stimulating remedies, the *ung. digestivum basilicum*, the oil of turpentine, decoction of oak bark, bark with tincture of myrrh, filling the cavity of the abscess with charpie, strong solution of nitrate of silver, with which is to be moistened the charpie laid in the cavity of the abscess. But all these means are superfluous; the moist warm poultices are more effectual in raising the vital activity necessary for the secretion of good pus, the pus thereby more readily escapes, and the patient is saved from the troublesome and painful dressings by the sticking of the bandages. If the patient's strength fail and general weakness ensue, strengthening remedies, bark, rhatany, sweet flag, good nourishment, the enjoyment of pure air, and so on, are indicated.

64. If the edges of the abscess-aperture unite, whilst the secretion of pus continues, they may be easily drawn asunder or separated with a probe. Should the opening become too small, so that the pus cannot escape freely, it must be enlarged with the knife. If the granulations are developed too strongly, the *proud flesh (Caro luxurians*, Lat.; *Wucherndes Fleisch*, Germ.) must be touched with nitrate of silver and a compressing bandage applied, by which cicatrization is specially encouraged.

65. When the pus does not escape properly, but collects in the abscess, (which may depend on the opening being too small or upon some peculiar situation of the abscess,) it sinks down in consequence of its own weight, or the little opposition which the loose cellular tissue in the interspaces of the part offers to it, or the suppurative process may extend with failure of the adhesive inflammation, and, on the other hand, an ulcerative absorption may favour the extension of the abscess, and form cavities or canals which are called *fistulous passages (sinus fistulosi.)* These fistulous passages are often consequent on improper treatment, if the opening of the abscess be stopped by plugs, and so on, and the due flowing of the pus thereby prevented. Under these circumstances a much larger quantity of pus escapes from the abscess than from its size might be expected; especially if its neighbourhood be pressed in different directions; examination with the probe gives certain knowledge of its extent. If such fistulous passages remain long, their walls are overspread with a soft fungous membrane, similar to mucous membrane, which prevents the healing, and, when still longer continued, assumes a whitish, hard, callous condition.

The membrane of the fistula first pointed out by HUNTER, has been well described by VILLERMÉ (*a*), LAENNEC, and BRESCHET (*b*).

[The passage in HUNTER here alluded to is the following:—"When the parts are unsound, and of course the granulations formed upon them unsound, we have not this disposition for union, but a smooth surface is formed, somewhat similar to many natural internal surfaces of the body, and such as have no tendency to granulate, which continues to secrete a matter expressive of the sore which it lubricates, and in some measure prevents the union of the granulations. I imagine, for instance, that the internal surface of a fistulous ulcer is in some degree similar to the inner surface of the urethra, when it is forming the discharge commonly called a gleet. Such sores have therefore no disposition in their granulations to unite, and nothing can produce an union between them but altering the disposition of these granulations by exciting a considerable inflammation, and probably ulceration, so as to form new granulations, and by these means give them a chance of falling into a sound state." (p. 480.)]

(*a*) In Journal de Médecine, par LE ROUX, July, 1815.
(*b*) Dictionnaire des Sciences Médicales, vol. viii. p. 203. Journal von GRAEFE und WALTHER, vol. ii. part iv.

66. These fistulous passages may be generally avoided by the treatment already mentioned. If the fistulous passage be still recent, the free escape of the pus may be effected by a suitable enlarging of the opening, by the entire division of the fistulous passage, if it be superficial; or, if the bottom of the passage be near the skin, by means of a counter opening; for the latter purpose a probe is introduced, with which the bottom of the passage and the skin above it are raised, and then the probe is to be cut upon. The further treatment is to be according to the preceding rules. In still longer continued fistulous passages, especially when their walls have become callous, we endeavour to excite a proper degree of inflammation of the walls of the passage, usually by the introduction of a seton, or of a bundle composed of many threads, which is tied together externally upon the fistulous passage, and daily drawn tighter (LANGENBECK) (*a*), or by the injection of irritating fluids (H. DEWAR) (*b*); for instance, a solution of nitrate of silver, of bichloride, or nitrate of quicksilver, or by the introduction of a bougie, the point of which has been smeared with powdered nitrate of silver (CRAMER) (*c*), (VON WALTHER) (*d*), and so on, and then, by a regulated pressure throughout its whole extent, to produce union of its walls. Where a satisfactory dilatation of the fistulous passage is possible, the cure may be effected without these painful remedies by the careful avoidance of any bandage which might interfere with the escape of the pus, and by close attention to the before-mentioned rules.

According to LANGENBECK, the introduction of a ligature is, in many cases, preferable to incision, which oftentimes is impracticable without injuring large vessels, and so on. By the ligature inflammation is produced, the surface of the abscess becomes red and painful, the secretion of ichorous fluid is diminished, good consistent pus and near the ligature shooting healthy granulations are produced, and the skin becomes more firm and solid. As these symptoms come on, the ligature is to be gradually drawn tighter. In common cases, the ligature requires to be used only from four to eight days, to produce its effects. If it should be necessary to cut through the wall of the fistulous passage with the ligature, the remaining cavity must be filled with charpie.

67. During suppuration the practitioner must pay especial attention to the condition of the digestive organs; for impurities in the intestinal canal are frequently the cause of unhealthy pus; neither must pure healthy air be forgotten.

If the suppuration be continued on account of any dyscracy, the proper means for its counteraction must be employed.

On the treatment of abscess compare

VON KERN, Annalen der chirurgischen Klinik zu Wien, vol. i. 1807, vol. ii. 1809.

VON WALTHER, über die topische Behandlung und über den Verband der eiternden Wunden, der Abscesse, Geschwüre und Fisteln, in Journal für Chirurgie und Augenheilkunde, vol. ix. part ii.

68. The treatment of the Hardening into which inflammation has subsided has a double object, viz. its *dispersion* or its *removal with the knife*. The resolution of the hardening is only possible when the lymph poured into the cellular tissue has not yet consolidated the walls of the part with each other, and its natural structure is not yet entirely lost; consequently, when the *induration is still recent and not very hard*. If there be also decided dyscracy, the curative treatment must be first directed to it.

(*a*) Von der Behandlung der Fistelgänge, der Schusscanäle und grosser Eiter absondernden Höhlen; in Neue Bibliothek für die Chirurgie und Ophthalmologie, vol. i p. 2, par. 313.

(*b*) On the Treatment of Sinuous Ulcers; in Medico-Chirurgical Transactions, vol. vii. p. 487.

(*c*) Beitrage zur Heilung der Fisteln und Geschwüre; in Heidelberger clinischen Annalen, vol. x. part i. p. 71.

(*d*) Uber Hohlgeschwüre und Fisteln; in Journal von GRAEFE und WALTHER, vol. v. p. 1.

For the resolution of hardening it is usual to employ the *saponaria*, the *taraxacum*, *gramen*; the *gummi ammoniacum*, *galbanum*; *cicuta*, *belladonna*, cherry-laurel water, various preparations of mercury and antimony; the soaps, alkalies and so on: for external use, warm bathing especially with or without alkalies, infriction of volatile salves, mercurial ointment; various plasters, the *empl. de cicutâ c. ammoniaco*, *de mercurio c. camphorâ* and so on; fomentations of narcotic plants; electricity, and galvanism. The repeated application of leeches, the internal and external use of mercury, and iodine, the employment of derivative remedies, with a better regulated and rather strict mode of living, act most satisfactorily.

69. These means must be used with discretion, and not pursued too long, because, otherwise, the general health will be much disturbed or inflammation and transition of the hardening into other kinds of disorganization, or even into cancer, may be produced. When, therefore, resolution is not effected, or when it cannot be attempted, it is most advisable to remove the hardened parts with the knife. If the patient will not submit to the operation, the hardening must be protected as much as possible from external influences; it must be kept warm, attention must be paid to the secretions and excretions; the patient must live regularly, and specially preserve himself from all depressing emotions of the mind.

70. Gangrene is always the loss of vital activity in some part; but the variety of its causes and of the circumstances connected with it render very different kinds of treatment necessary, *in order to stop the further spreading of the gangrene, to assist nature in throwing off the gangrenous part, and to prevent the operation of the gangrenous juices acting upon other parts of the body.*

71. Gangrene may be specially connected with inflammatory, nervous, or gastric fever, with general debility or increased sensibility and convulsions.

When it is consequent on active inflammation and accompanied with inflammatory fever, which is specially the case in young strong persons after external injury and so on, a moderating antiphlogistic treatment can only be employed, and emollient poultices to hasten the throwing off the gangrene. If the gangrene arise from the confinement of the inflamed parts by unyielding aponeuroses, the removal of these mechanical hinderances, by suitably deep and extensive incisions, can alone prevent the production or further spreading of the gangrene.

In most cases the gangrene is connected with general debility, nervous or putrid fever, and then especially is indicated the use of bark with valerian, arnica; serpentaria, fluid hartshorn, diluted acids; naphtha, wine, and so on; if there be putrid symptoms, bark with mineral acids and alum. It must not be forgotten, however, that not unfrequently, under these circumstances, wine and animal food decidedly increase the febrile heat, the pulse becomes quicker, the tongue coated, and the patient very uneasy. A less irritating diet, and only so much mild, nourishing, and farinaceous food as the appetite requires and the stomach can bear, is then more proper.

Not unfrequently in gangrene there is a loaded state of the bowels, which must be as early as possible removed, and then the strengthening remedies employed. In greatly increased sensibility and convulsions, opium, musk, fluid alkalies, and other antispasmodic means are to be used.

72. The *Local Treatment* of gangrene has the two-fold purpose of supporting nature in throwing off the slough and in diminishing the dangerous operation of the gangrenous juices.

If the gangrene be connected with active inflammation, softening, and in very severe pain, soothing poultices are to be used; but, if the gangrenous part be free from pain and shrivelled, stimulating remedies are required, in order to excite suppuration on the boundary of the slough; with which object it is most advisable to use warm aromatic poultices.

The remedies which prevent the influence of the gangrenous juices, by absorbing or decomposing them, are quinine, oak or chestnut bark, camomile, vinegar, wine, brandy, camphor, hydrochlorate of ammonia, turpentine, diluted mineral acids, pyroligneous acid, carbonic acid, effervescing fluids, powdered charcoal. In moist gangrene, these substances are better used in powder, but in dry gangrene fomentations or poultices. In all cases the stench is best diminished by the employment of aromatic or simply moist warm poultices, and by suitable cleansing at each time of their renewal. It is still further lessened by the very useful strewing of powder, which, by its partial drying, often directly prevents the outflowing of the gangrenous juices.

The operation of these remedies may be promoted by scarification or cutting into the gangrenous parts. The scarifications must not, however, penetrate into the living part, or they will favour the action of the gangrenous juice, accelerate the increase of the gangrene and cause dangerous bleeding; their principal object must be *to prevent the collection of the gangrenous juices.* In the gangrene of old people (*gangræna senilis*) scarifications are always dangerous; so long as the toes are still attached at some parts, they must not be removed.

73. The sloughs having been thrown off by this treatment, the remaining wound must be managed according to the rules laid down for treating abscesses, and the vital activity of the patient must be supported by the suitable employment of bark and a nourishing strengthening diet.

74. In most cases nature, after the gangrene is defined, throws off the gangrenous part, and *amputation is not required.* Amputation *is not applicable* in gangrene depending on an internal cause which is still in operation; for, in such case, after the performance of amputation, gangrene again takes place in the wound. But when the gangrene has affected the whole thickness of a limb, and is defined, and the separation of the dead part cannot be expected; or, when produced by external violence, it is proceeding, but the causes of the gangrene can be removed with the gangrenous part, amputation is to be considered as necessary and likely to save life (1). It is, however, here to be borne in mind that gangrene in the deeper parts commonly makes further progress than the external appearance indicates. The amputation must always be performed in the healthy part.

(1) Such is the opinion of LARREY (*a*); but the opposite is especially supported by POTT.

When the gangrene remains stationary, the greatest danger is over. However desirable it may be to relieve the patient of the mortified part, yet in many cases is he unable to bear the shock of the operation. Here, then, in combination with a treatment suited to the diseased condition of the patient, it is more advisable, if the soft parts are divided down to the bone, to saw the latter through below the limits of the healthy part. Diseased condition of the remaining ulcerated surface, may at a subsequent period render amputation necessary.

[So far as my experience is concerned, I believe that amputation should on no account ever be performed, so long as the gangrene is in progress, whatever be its cause;

(*a*) Mémoires de Chirurgie Militaire, vol. iii. p. 142.

for, if it be, the same action will be set up in the stump, and the patient's condition rendered worse by the shock of the operation. Only when the gangrene is proved to have stopped, by the line of separation having descended to some depth in the soft parts, is amputation to be entertained.—J. F. S.]

75. The treatment of *senile gangrene* must depend on the different modes in which it has arisen (*par.* 26.). When livid redness and swelling set in as a consequence of injury, or any other locally operating mischief, softening, soothing, or dry aromatic compositions must be applied, according to the circumstances; in more active inflammation, and in robust persons, leeches should be used. It is proper to allude to these cases, and especially when occurring in plethoric subjects, as DUPUYTREN (*a*), by the employment of the antiphlogistic method, by bleeding and leeching, professes to have met with successful results. The general treatment must correspond with the local; in very severe pain opium in considerable doses should be given (*b*), and, according to circumstances, with tonic medicines. In the other kind of senile gangrene, which comes on with blackening and shrivelling of the part, tonic means in combination with volatile applications with the addition of opium if there be pain, and the local employment of soothing poultices, can alone produce the limiting and throwing off the slough, and respite life for some time.

I have communicated (*c*) an interesting example of senile gangrene of the hand and fore arm, in a woman of eighty-two years of age, in which by proper support of the powers separation of the slough and healing ensued. Compare also HEIM (*d*).

76. Gangrene from pressure by lying is to be guarded against by suitable preparation of the bed, by lying on a mattress instead of a feather-bed, by proper cleanliness, frequent change of the body-linen and sheets, repeated alteration of position, by putting doe-skin beneath the patient, by frequent washing the compressed parts with cold water, lead wash and camphorated spirit. If the part have become red, it must be laid on a hollow formed by introduction of ring-shaped pads, little bolsters of horsehair, cleft mattresses, and afterwards compresses moistened with lead wash, vinegar, or THEDEN'S arquebusade water must be applied, or the part must frequently be smeared with an ointment of white of egg and camphor beaten to a cream. When ulcerative absorption has occurred, softening poultices, ointment of oxide of zinc, or of lead, with opium or camphor, should be applied, and, if the ulceration be spreading and deep, aromatic poultices. If actual gangrene be present, then the ordinary treatment for gangrene must be employed. Of course the treatment of the patient's health should be guided by the state of the disease.

In many cases where it is difficult to move the patient, the application of local means may be assisted by the use of LECAT'S suspending mat (*e*), or LEYDIG'S (*f*) apparatus for raising invalids.

77. In gangrene after the use of cockspurred rye, vomiting and purging must be had recourse to, and subsequently both internal and external stimulating remedies. In many cases amputation has been performed, which, however, has not always been of service, because, especially in patients who had been much weakened, the same changes took place in the stump. If the gangrene has become defined, it is most

(*a*) In BALLING, as above.
(*b*) POTT, Observations on Frostbite on the Toes and Feet; in his Surgical Works, vol. iii. p. 189 *et seq.* Ed. 1808.
(*c*) Heidelberger klin. Annalen, vol. vi, part i.
(*d*) Schweiz. Zeitschr. für Naturw. u. Heilk, vol. ii. part. i. p. 73.
(*e*) Philosoph. Trans. 1742, p. 346.
(*f*) Der Krankenheber, &c., mit 2 Kupf. Mainz, 1812.

advisable to leave the separation of the parts to nature and saw off the bone.

Full reports of observations on this subject are to be found in THOMSON (*a*) and in SAMUEL COOPER (*b*).

78. The treatment of *malignant pustule* varies according to the accompanying symptoms. The local treatment consists in cutting out the pustule by a circular incision, and afterwards cauterizing the edges of the wound with nitrate of silver or sulphuric acid, (also with the actual cautery,) and placing upon it charpie moistened with oxymuriatic acid. The slough is to be covered with a softening bran poultice, and, after it is thrown off, the treatment of the wound is to be simple. If the pustule be not deep, but the slough much outspread, it is proper to make deep scarifications and employ the remedies just mentioned. If general symptoms are not present, it is only necessary to use sulphuric acid or HALLER'S acid mixed as a drink. If there be indications of gastric impurities, emetics must be employed in divided but sufficiently effectual doses, and, if they do not operate, purging, or vinegar clysters must be used. If the powers sink and nervous symptoms appear, strengthening and stimulating medicines are required; bark, serpentaria, arnica, valerian with elixir of vitriol, hydrochloric acid, and so on. But bleeding is rarely required, unless in decided plethora and great determination of blood to the head and chest.

On malignant pustule see

LARREY, as above, vol. i. p. 52.

HUFELAND'S Journal, vol. li. part v.; vol. liv. part iii.; vol. lvi. part iv.

RUST'S Magazine, vol. xv. part i.; vol. xvi. part iii.; vol. xvii.

J. N. HOFFMANN, der Milzbrand, oder contagiöse Carbunkel der Menschen, mit Berucksichtigung einiger damit zu verwechselnder Krankheitsformen und einer fragmentarischen Uebersicht des bei den Thieren herrschenden Milzbrandes. Stuttgardt, 1827. 8vo.

RASEDOW, die schwarze Pocke; in Journal von VON GRAEFE, u. VON WALTHER, vol. vii, p. 185; vol. xii. p. 549.

SCHROEDER, über die schwarze Blatter; in RUST'S Magazin, vol. xxix. part ii.

WENDROTH, über die Ursachen, Erkentniss und Behandlung des contagiösen Carbunkels. Sangershausen, 1838.

79. It is apparent, from the nature of the causes of *hospital gangrene*, already mentioned in what way this dangerous complication of wounds and ulcers can be guarded against. Care must be taken as much as possible for purity of air and proper diet with a moderate use of wine; the greatest cleanliness of the bandages must be observed, the wound must be washed with a light aromatic infusion or with diluted alkaline solutions, and symptoms of gastric impurity must be removed by vomiting and purging. Emetics are especially advised by POUTEAU, DUSSAUSOY, and others, as the most important remedies at the beginning of the disease. They recommend them as being of themselves capable of stopping the advance of the disease.

If the peculiar changes occur in the wound or in the sore, (*par.* 35,) washing the whole surface with good vinegar, after thoroughly cleansing with charpie, and frequently moistening the bandage with vinegar, is often sufficient at the onset to restore the wounds in a few days to their former condition. For the same purpose also is the solution of arsenic recom-

(*a*) As above, p. 538. (*b*) Dictionary of Surgery, article Mortification.

mended. If the surface of the wound do not improve in appearance, its entire extent should be touched with nitrate of silver, or conical pieces of caustic laid in the viscid mass. But, under these circumstances, the most important remedy is the free application of the actual cautery to the whole surface of the ulcerated part. The slough is to be covered with powdered bark and turpentine or some stimulating salve, and when the slough has separated, the appearance of the wound must determine whether the application of the cautery is to be repeated or not. Besides these means, the following may also be recommended; decoction of bark, diluted mineral acids, especially hydrochloric acid, yeast poultices, spirituous lotions, brandy and myrrh, aloes and camphor, hydrochlorate of ammonia with water and vinegar, *spir. terebinth*, *ung. styrac.* and *Egyptiacum*, balsam of copaiva, solutions of bichloride of mercury and nitrate of silver, butyr of antimony, pyroligneous acid, lemon juice and so on.

80. General treatment, suited to the different condition of the patient, must also be connected with this local treatment. At the onset, if symptoms of irritation and active febrile excitement are present, acid drinks, especially dilute mineral acids, are serviceable; in impurities of the stomach, emetics; in great weakness, bark and other tonic remedies; only in rare cases is a strict antiphilogistic plan of treatment called for. The diet must of course correspond with the general treatment, and care should be taken for purity of air and keeping the patient apart from others.

On hospital gangrene compare

Pouteau, Œuvres Posthumes, vol. iii. 1783. 8vo.

Gillespie, Leon, Observations on the Putrid Ulcer; in London Medical Journal vol. vi. p. 373. 1785.

Dussaussoy, Sur la Gangrène des Hôpitaux. Genève, 1787. 8vo.

Blane, G., M.D., gives an account of this gangrene, by the name of Malignant Ulcer, in his Diseases of Seamen, p. 502, 3rd Edit., London, 1799.

Trotter, M.D., describes it by the same title in his Medicina Nautica, vol. ii. p. 170; vol. iii. p. 467.

Bell, John, Principles of Surgery, vol. i. p. 136.

Leslie, De Gangrænâ Contagiosâ. Edinburgh, 1805.

Johnson, Charles, M.D., de Gangrænâ Contagiosâ Nosocomiale. Edinburgh, 1805.

Thomson, John, in his Lectures on Inflammation, p. 456.

Renard, über den Hospitalbrand. Mairz, 1815. 8vo.

Gerson, über den Hospitalbrand, nach eigenen Erfahrungen. Hamburg, 1817. 8vo.

H. Blackadder, Observations on Phagedæna Gangrænosa. Edinburgh, 1818. 8vo.

W. Werneck, kurzegefasste Beiträge zur Kenntniss der Natur, der Entstehung, der Verhutung und Heilung des Hospitalbrandes. Salzburg, 1820. Large 8vo.

Brauer, Observationes quædam de Gangrænâ Nosocomiali, quæ anno hujus sæculi xiv. Lipsiæ inter milites variarum nationum grassata est. Lipsiæ, 1820.

Alexander, über den Hospitalbrand; in Hippocrates Magazin von Sander und Waepter, vol. v. p. 1—220.

Delpech, Clinique Chirurgicale de Montpellier, vol. i. p. 78.

Boggie, in the Transactions of the Medico-Chirurgical Society of Edinburgh, vol. iii. p. 1. 1828.

Ollivier, A. F., Traité experimental du Typhus Traumatique, Gangrène ou Pourriture des hôpitaux. Paris, 1822. 8vo.

SECOND SECTION.—OF CERTAIN PECULIAR KINDS OF INFLAMMATION.

I.—OF ERYSIPELAS.

RICHTER G. G., Diss. de Erysipelate. Goetting, 1744. 4to.

THIERENS, A. L., Diss. de Erysipelate. Lugd. Batav., 1790.

WINKEL, L. H. O., Aphorismi de cognoscendo et curando Erysipelate. Erlang., 1794. 8vo.

FERNE, W. C. S., Diss. de diversâ Erysipelatis naturâ. Franc ad Viadr., 1795. 4to.

DESAULT, Observations sur Diverses Espèces d'Erysipèles; in Journal de Chirurgie, vol. ii. p. 13. 1791.

RUST, das Pseudo-Erysipelas, eine noch nicht hinreichend erkannte Krankheitsform; in his Magazin, vol. viii. part iii. p. 498.

HUTCHINSON, A. C., Practical Observations on Surgery. 2nd Edit. London, 1826. chap. ii.

PAULI, über Phlegmone telæ cellulosæ; in RUST's Magazin, vol. xxvii. p. 129.

LAWRENCE, WILLIAM, Observations on the Nature and Treatment of Erysipelas; in Medico-Chirurg. Trans. vol. xiv. part i. p. 1.

DUPUYTREN, Du Phlegmon Diffus; in Leçons Orales, vol. ii. p. 289.

FENGER, C. E., Diss. de Erysipelate ambulanti. Haoniæ, 1842.

81. Under the terms *Erysipelas*, *St. Anthony's Fire*, (*Rosa*, *Erysipelas*, Lat.; *Rose* oder *Rothlauf*, Germ.; *Erysipèle*, Fr.,) is usually understood an inflammation of the lymphatic vascular network overspreading the surface of the cutis, in which, not unfrequently, the skin, glands, and Malpighian mucous net, but more rarely the cellular tissue and muscles lying beneath, partiticipate. Under this general notion are included a number of diseased conditions which are considered as modifications of erysipelas, but in their nature are entirely different from it. RUST has the merit of having pointed out their special points of difference, and recognises a *True Erysipelas* (*Erysipelas verum* seu *exanthematicum*, Lat.; *ächte Rose*, Germ.) and a *False Erysipelas* (*Erysipelas spurium* seu *Pseudo-Erysipelas*, Lat.; *unächte Rose*, Germ.)

[HUNTER long since observed, that "most inflammations that are not of the true adhesive and suppurative kinds are called erysipelatous, although, probably, they do not in the least belong to it." (p. 269.) And CHELIUS has echoed him in the above observation, that "a number of diseased conditions, which are considered as modifications of erysipelas, in their nature are entirely different from it." But he has not at all, by his arrangement, mended the matter, and I have, therefore, pointed out, first, the different applications of the terms erysipelas and erythema, which are employed by him very contrarily to our ordinary usage of them; and, afterwards, I have shown that one of his forms of erythema is really that important disease, inflammation of the cellular tissue, which, by other writers as well as by him, is confounded with inflammation of the skin, and often mentioned as gangrenous erysipelas. It is, however, right to observe that our author has, at the end of paragraph 83, shown that he is not unaware of the impropriety of considering this disease as an affection of the skin.—J. F. S.]

82. The *True Erysipelas* appears without any local disposition to disease, but with previous general indisposition, which is usually shown by

weakness and heaviness of the limbs, listlessness, pain in the region of the stomach, loaded tongue, nasty taste in the mouth, disposition to vomit, more or less active fever, head-ache, wandering, lethargy, or madness,—as a pale uncircumscribed redness of the skin, fading into yellowish, which spreads unequally, is shaded off towards the edge, disappears on pressure with the finger, but returns when the pressure is removed. After the appearance of the erysipelas the fever generally diminishes or disappears; but every fresh attack is accompanied with fever. The seat of this erysipelas never extends beyond the lymphatic-vascular net overspreading the surface of the cutis. The severity of the disease is as various as is the condition of the part first attacked; it, however, usually subsides under critical discharges of perspiration and urine, and with scaling of the skin; it never runs into suppuration, but only, with weakly constitutions and other concurrent circumstances, into ulceration and gangrene, in consequence of which the destruction of the surface of the body extends to the parts beneath, and there ensues, not a bounded fluctuating abscess, but an open, wide-spreading, putrid, ulcerating surface. If the scaling of the skin, critically following the erysipelas, be disturbed by moist remedies, by cold and so on, dropsical swelling ensues. This erysipelas is very fugitive; it subsides of itself; but more commonly after the external use of moist remedies, of cold, or on mental emotions, and so on, it suddenly quits the surface, and causes inflammation of the brain, chest, or belly, madness, convulsions, paralysis, and so on. The true causes of this erysipelas are biliary irritation, disturbance of the functions of the liver, collections of gastric impurities, use of indigestible food, obstruction in the portal system, and a prevalence of peculiar atmosphere and temperature, in consequence of which it seems to be commonly epidemic, especially towards autumn and during summer.

Compare BALLING, das Akklimatisations-Erysipelas; in Heidelberg Klinischen Annalen, vol. vii. p. 176

The *Vesicular Erysipelas (Erysipelas vesiculare, bullosum)* is a variety of this kind of erysipelas, in which either at the onset, or in the course of the disease, vesicles of various size arise, sometimes like a miliary eruption, sometimes like peas or hens' eggs, which often run together, and, after bursting, form crusts, or, frequently, spreading sores.

[(1) The disease here described as true erysipelas by CHELIUS, is the *erythema* of English practitioners, and which has been well described by WILLAN (*a*) as "a nearly continuous redness of some portion of the skin, attended with disorder of the constitution, but not contagious" (p. 472;) and BATEMAN (*b*) observes, that "it differs from erysipelas inasmuch as it is a mere rash or efflorescence, and is not accompanied by any swelling, vesication, or regular fever." (p. 119.) RAYER (*c*) speaks of it as a superficial inflammation of the skin, characterized by morbid redness and heat, and the absence, for the most part, of papulæ, vesicles and pustules. (vol. i. p. 98.) Elsewhere he observes, that "it is the first stage of a number of cutaneous affections, but when permanent it constitutes a disease in itself." (p. 95.)

The vesicular erysipelas, which CHELIUS considers merely as a variety of his erysipelas, is a distinct and definite disease, the acute erysipelas of WILLAN and BATEMAN, which "most frequently occurs in the face, affecting usually one side of it only; sometimes it seizes one of the extremities, and in both cases it is ushered in by a smart feverish attack. The colour is higher than in the other species of the disease, and the burning heat and tingling in the part are exceedingly distressing. The swelling generally appears on the second night or third day of the fever; the vesications rise on the fourth and fifth, and break or subside on the fifth or sixth, when the redness changes to a yellowish hue, and the swelling and fever begin to diminish; and on the eighth day

(*a*) On Cutaneous Diseases. Lond., 1808. 4to. according to the arrangement of Dr. WILLAN.
(*b*) A Practical Synopsis of Cutaneous Diseases London, 1819. 8vo. 15th Edition.
(*c*) Traité Théorique et Pratique des Maladies de la Peau. Paris, 1826. 2 vols. 8vo.

both disappear; on the tenth the new cuticle is commonly left exposed, the old one having separated, and the brownish or dark scab, which had formed where the fluid of the vesications had been discharged, having fallen off." The disease runs its course more quickly in the young than in those of more advanced age; and "the vesications, in the latter instances, are often succeeded by a profuse discharge of acrimonious lymph for several days, so that scabs do not form. Suppuration very rarely occurs in this species of erysipelas, especially when it affects the face." (pp. 126, 7.)

From this description it is quite evident that CHELIUS is incorrect in making his vesicular erysipelas a variety of his true erysipelas; the latter being really erythema, and therefore an exanthematous disease, whilst the former, which is our acute erysipelas, is a bullous disease. It was necessary also to make these observations to prevent the confusion which would otherwise arise from the acceptation in which CHELIUS uses the terms erysipelas and erythema, differing so entirely from that in which they are employed by English writers.—J. F. S.]

83. The *Spurious Erysipelas* or *Pseudo-Erysipelas* is a continual inflammation of the skin with some redness, (*Erythema*,) which has nothing in common with the true erysipelas but its external appearance, and is produced by any pretty strong irritation of the skin. Influences of this kind are, scorching by the sun, slight burning, cold, irritating ointments and plasters, cantharides, mustard plaster, horse-radish, the juice of toxicodendron, hard rubbing, wounds and injuries of all kinds, stagnant humours, swellings, hardenings, and so on. Hence inflammation of the skin is produced, either directly or indirectly; in the first case appearing immediately, in the second as a consequence of some other disease, which has been excited by inflammation. The inflammation of the skin, thus produced, is either superficial, or it penetrates deeper into the substance of the skin. The former is more like erysipelas, but the latter has rather the character of phlegmonous inflammation, and the more the cellular membrane and muscles are attacked by it, so much the less does the disease deserve the name of inflammation of the skin.

84. According to its various causes, *Pseudo-Erysipelas* is divided into two kinds:—

First. The *Erythema idiopathicum*, which is merely consequence of external irritation (from cold, heat, corrosive substances, slight injuries, and so on.)

[A very frequent form of idiopathic erythema is that caused by friction, and commonly known as *Intertrigo*, which is well exemplified in the chafing of the skin in fat persons; often also noticed in the folds of the skin of the neck, groin and hams, and behind the ears of infants, and resulting from inattention to cleanliness, the moisture and sebaceous secretions which are left on the delicate skin of these parts irritating it, so that often the character of the perspiration is changed to clamminess, and its quantity increased, and, where it can dry, superficial thin scabs are formed, even before excoriation of the skin occurs, which soon takes place, and, if left alone, runs on to gangrene. Erythema may also originate from the flow of other natural secretions over the skin, as the spittle over the chin and neck, if the lower lip be imperfect, or do not retain its proper place; the urine, in incontinence or in perineal fistula; the tears over the cheek; and so also the increased and altered mucous discharge from the nostrils during catarrh, will cause severe erythema of the upper lip.—J. F. S.]

Second. The *Erythema symptomaticum, consensuale*, which is the simple reflection of another disease of the structures lying deeper beneath the skin. This other disease may be,

A. An inflammatory or serous distension of the tendinous expansions, and aponeuroses, with the intensity of which the accompanying inflammation of the skin increases, and oftentimes spreads very far, as, for instance, in œdema, in injuries of the head, in whitlow, and so on.

[This is the "erysipelatous inflammation" which, HUNTER says, "often arises from

accident; but then it is commonly a secondary inflammation, although not always; for, the first shall have gone off, and, when the suppuration was to take place, it shall have come kindly on, but afterwards the erysipelatous shall take place. * * * It is more commonly a cutaneous inflammation than situated in the deeper-seated parts; although, in some constitutions, every inflammation, wherever it exists, will most probably be of this kind; however, the skin appears to be most susceptible of it, because it will spread over a prodigious surface of skin, while it does not affect even the cellular membrane underneath. * * * It is more common in the summer than in the winter, more especially in hospitals; and, I think, takes place oftener after wounds on the head than any other. I have often seen it begin round a wound on the scalp, extending itself over the whole head and face; the eyelids being very much swelled, the ears thickened, and it has advanced to the neck, shoulders and body; creeping along both arms, and terminating at the fingers' ends: that which attacks the body, often goes along the body to both thighs, down the legs, and terminates at the ends of the toes; and, while this is going on, it is as expeditiously cured behind, and the skin peels off the cured parts: however, this is not always the case; it often stops, and where it proceeds so far, it is commonly becoming milder." (pp. 270, 1.)

The form of the disease just described by HUNTER, is the *erratic erysipelas* of WILLAN and BATEMAN. It, however, more commonly occurs on the limbs and body, than on the head, and frequently accompanies punctured wounds, or poisoned wounds in dissection. In the latter cases, it is often extremely troublesome, and continues for weeks; making its appearance in the neighbourhood of the wound, after the more severe symptoms, either without or with suppuration and sloughing, have subsided, and the patient seems nearly convalescent: it will run up and down finger after finger, consecutively, and I have known the fingers thus affected twice or thrice during the same attack.

That form of the disease which sometimes follows scalp-wounds is rather the *œdematous erysipelas* of WILLAN and BATEMAN than the erratic. It is described by those writers "of a paler red, or of a yellowish-brown colour, is accompanied by less heat and local distress" than true, or even erratic erysipelas; "its surface is smooth and shining, and, if it be strongly pressed with the finger, a slight pit remains for a short time." The scalp swells enormously, and the disease spreads more or less slowly and extensively, till "the whole face is much enlarged, so that the form of the features is scarcely recognised, and the appearance is not unaptly compared by WILLAN to that of a bladder distended with water." (p. 127.) Generally, as far as I have observed, this œdematous erysipelas is not accompanied with vesication.—J. F. S.]

B. A metastatic deposit in the cellular tissue, periosteum, and glands, in gastric, rheumatic, arthritic, and puerperal diseases. In such cases, when the masses deposited are fluid, the parts attacked quickly die, and are given up to the ulcerative process. Often, within a few hours, in a previously healthy part, (mostly of the thigh or leg, especially on the right side in persons advanced in years,) a redness of the skin comes on with fluctuation and diffused pain, in which, after opening the abscess, whole sheets of dead cellular tissue may be withdrawn; and, if the periosteum be involved, the bone may be felt bare. Usually, however, its course is not so quick; the local pain is preceded by more or less severe shiverings which, from their repeated accessions, resemble an ague. The fever continuing, the skin is rosy red at the painful parts, and somewhat œdematous, so that it retains the impression of the finger. The fever becomes more active, the swelling harder, the redness bluish, the skin grows shining and blisters, the cellular tissue is hard and firm, the urinary and fecal discharges are changed and suppressed; with accompanying restlessness, and great agitation. At this point the disease seems to stand still; the heat, tension, and pain are unaltered; the vesicles have the same appearance. If at this time the skin and cellular tissue be cut into, a quantity of whitish fluid with a little pus escapes, a few days after, less of the thin fluid, and more pus; and, still later, a whitish lard-like substance, and upon pressure only a very little pus; the cellular tissue is dead. When it has gone thus far, the skin is destroyed, the

vesicles burst, a whitish ichorous fluid is discharged, whitish or blackish spots appear which quickly spread, the cellular tissue is thrown off in large patches, the skin is entirely separated from the underlying parts, all the connecting cellular tissue between the muscles is destroyed, the skin becomes gangrenous, the suppuration is very plentiful and offensive, the destruction spreads and exhaustion follows with copious sweats, purging, and so on. If the patient's powers revive, and the disease be arrested, the formation of granulations and cicatrization is always very tedious, on account of the great destruction of the cellular tissue (1). If the masses deposited be solid, they sink into the substance of the cellular tissue, inflame and harden it, and destroy its vital relations, without causing actual death. This degeneration frequently does not occur until after several weeks, and appears with accompanying redness of the skin and with a somewhat painful, far-spread, deep-seated hardening (2). The termination of this disease (which KLUGE has commonly observed in the scrotum, and which I have seen upon the hand and fore arm) is either a tedious resolution with gradual subsidence of the redness and hardness, or death of the degenerated organ, in which the size of the part is increased, the previous hardness becomes doughy, fluctuation takes place, and the above-described destruction and *ichorousness* ensues (*a*).

[(1) This is the *inflammation of the cellular tissue*, to which I slightly adverted at p. 72; and, although very commonly confused with erysipelas, or, as by CHELIUS, with erythema, it is decidedly different from either, although both occasionally run into it. JOHN HUNTER was well acquainted with it, as will be presently seen, though he included it with erythema, under the common title erysipelatous inflammation, which he does not describe at all. He says:—"The erysipelatous inflammation is very peculiar; and most inflammations that are not of the true adhesive and suppurative kind are called so, although probably they do not in the least belong to it; and this may arise more from the want of terms, than the want of discrimination." (p. 269.) After describing erythema, which it is quite certain he means, restricting it to the skin, he proceeds:—"When it (the inflammation) goes deeper than the skin into the cellular membrane, it often suppurates; but then I suspect it is not the true erysipelatous; for, in such cases, it commonly produces mortification in the cells, by which air is let loose; this gives a strange feel, neither of fluctuation nor crepitation, and, as there are no adhesions, the matter finds an easy passage into the common cellular membrane, increasing the same kind of suppuration wherever it comes; and, as mortification is a consequence of these inflammations, putrefaction ensues, and the discharge becomes very offensive. * * * * When it produces suppuration in the cellular membrane it is often dangerous, both from the disease itself and the consequences of the matter diffusing itself much farther. * * * The sores seldom ulcerate; they should be opened early, or the matter either gets into the cellular membrane from the want of adhesions, or it separates parts that are only attached, as the periosteum from the bone, muscles from muscles, etc. Whereas the true suppurative ulcerates briskly, which therefore should not be opened early, but allowed to burst." (pp. 271, 2.)

So far as it goes, HUNTER has well described this disease; but he speaks of it as if invariably consequent on erythema, which is more rare than its following erysipelas, which he does not mention at all. It is perfectly true that, from both these diseases, the inflammatory action may descend, and attack the cellular tissue; but very commonly the inflammation begins in that tissue; and the redness of the skin is only secondary, and symptomatic of the mischief going on beneath.

Inflammation of the cellular tissue arises frequently without any apparent cause, but sometimes follows a graze or slight wound or contusion of the skin. It commences with swelling, tension and dusky redness of the limb, (almost invariably attacking the extremities,) is very painful, and has a doughy feel; it spreads very rapidly, downwards as well as upwards if it have commenced on the upper or on the middle of the lower member of the limb. The pain and tension increase, the redness becomes darker, and, if not interfered with, large patches of the skin assume a gangrenous character, sometimes accompanied with large vesications loaded with dirty serum, but very often without

(*a*) KLUGE; in RUST, as above, p. 525.

them. Pressure upon the skin not unfrequently gives a crackling sensation. The gangrene of the skin continues spreading, and, generally, in the course of forty-eight hours or less, the greater part, or the whole, of the skin is sloughy. If there be sufficient power, ulceration takes place at the edge of one or other slough, and a little ichorous exudation is observed, which subsequently is followed by fetid pus, and sloughs begin to separate, simultaneously with which the character and quantity of suppuration are improved and increased, till the whole of the dead parts are thrown off; but this is a result which can scarcely be expected, for the patient is generally worn out before this can take place. The constitutional symptoms in this disease are at first those of great excitement and general disturbance; the skin burning hot and dry; the pulse quick and full; the alvine secretion unhealthy and the tongue dry; the patient becomes restless, soon wanders, becomes delirious, often violently, and then drops into a typhoid state, in which condition he speedily sinks. The disease is easily distinguishable from erysipelas, by the absence of vesication at the onset, and by its darker redness; also by its usually occurring in the limbs. But, as I have already mentioned, erysipelas may subside into it, as it not unfrequently does when attacking the scalp, and occasionally also when the face is affected, specially when the regions of the orbits are concerned, in which cases I have seen some very fearful sloughing of the cellular tissue in those cavities.

The disease generally attacks adults, and more especially persons accustomed to large quantities of beer and spirits, and gross feeding. In such persons the disease often seems to occur spontaneously, and at other times from the slightest cause, as a mere scratch. But I do not agree with CHELIUS that metastasis is generally, if ever, the cause of the disease.—J. F. S.]

(2) I have once or twice seen this degeneration in the scrotum; and I think I have noticed it occasionally in the legs of people addicted to drinking, in whom it seems to have been a commixture of adhesive deposit with the serum of œdema. But, many years ago, I had under my care a woman, between twenty and thirty years of age, whose face was thus affected, consequent on repeated attacks of erysipelas previous to my seeing her. Her forehead, and face especially, were considerably swollen and fiery red, having the appearance of skin distended with œdema, and threatening to burst; but it had not any such disposition. When pressed, it was found firm and but little yielding. She did not suffer pain in any material degree, but was principally inconvenienced by both eyelids being included in the disease, and so swollen that their apertures were little more than narrow horizontal slits, so that without bowing her head much forwards she could see nothing immediately below her for a considerable distance. All sorts of constitutional and local remedies having been employed without avail, it was proposed to her that some slices (they could only so be properly called) should be taken out of the swollen eyelids. To this she readily assented, being anxious for the slighest chance of relief; and, performing an operation similar to that for entropium, I removed a horizontal slice from between each tarsus and the corresponding edge of the orbit of both eyes, digging down to the bone, to the depth of half an inch, and cutting through cellular tissue literally converted into brawn; the gaping edges were then brought together, and, at first, she seemed a little benefited; but the wounds soon healed, and no advantage was derived. In a second operation, I removed some short vertical slices from the lower lids, but not with much immediate advantage. I have constantly seen her up to the present time, and, probably from the contraction of the scars, the apertures of the lids are increased but are still small. The face is also somewhat less, but it is still very full and deformed.—J. F. S.]

GULLIVER (*a*) mentions two peculiar affections of the cellular tissue which he has observed, and which he believes by no means uncommon among soldiers on service, who frequently "complain of inability to sustain the fatigue of marching, in consequence of swelling and pain in the feet and ankles, produced by this exercise. In many instances the cause of the affection is very obscure, and in some it may probably be ascribed to simulation; but I have seen cases in which the complaint was evidently connected with a change of structure in the subcutaneous cellular membrane of the legs, generally presenting itself in one of two forms.

"In the first and most numerous class of cases, after the patient has been long subjected to the inconvenience of swelling around the ankles and back of the feet, the disease assumes a more inveterate character,—that of thickening and induration of the subcutaneous cellular texture, so as to leave no further doubt of the incapacity of the man for active service. In one instance, in which the disease attacked the right leg, the part was

(*a*) Remarks on certain Affections of the Cellular Tissue of the Legs; in Edinburgh Medical and Surgical Journal, vol. xlvi. 1836.

constantly bedewed with perspiration, emitting a peculiarly offensive odour. The affection sometimes occurs in both extremities, and frequently in one only.

"In the second description of cases, although the soldier assigns the same cause of disability as in the preceding, the anatomical character of the disease offers a marked difference. There appear simply to be induration and rigidity, without thickening of the subcutaneous cellular substance. I know of no specific term by which it could be appropriately designated. The lower part of the leg, and frequently the back of the foot, appears hide-bound, the limb feeling hard and smooth, from loss of extensibility in the filamentous web, which no longer possesses that yielding looseness necessary to the due performance of its functions, so that the smallest fold of the skin cannot be grasped between the thumb and finger. The affection is unattended by swelling, except incidentally from unusual exertion. The examples which have come to my knowledge have been invariably confined to one extremity. * * * Of the first, which, in its advanced stage, may be considered as a species of compact œdema, we find no account in the accurate Treatise of Dr. CRAIGIE, and only a doubtful notice by Dr. OTTO; of the second, I am unaware of any description." (p. 309.) "The chronic induration and thickening of the cellular substance may probably arise from a variety of causes, of which repeated attacks of erysipelas appear to be one; but the first two cases described in this paper, as well as others which I have seen, were not preceded by inflammatory symptoms. Nor was there any swelling or pain in the tract of the absorbing vessels." * * * It would appear merely conjectural to refer the affection to a change in the veins; but the following circumstances are worthy of remark in connexion with the subject,—viz., the examples of phlegmasia dolens, from inflamed veins; of œdema of the lower extremities, from the accumulation of clots in the veins of the limb, without their obvious inflammation, and of chronic œdema from the irregular congestion of the capillaries, without any discoverable alteration of the venous trunks during life.

"But we have no reason to suppose that the induration without thickening of the cellular substance is dependent on any change in the veins; and, until the precise anatomical character of the disease has been shown by dissection, the descriptive appellation should be admitted with reserve. From the unaltered size of the limb, it is difficult to ascribe the hide-bound condition of the part either to hypertrophy or atrophy of the cellular substance; for which reason it appears most probable that the affection is simply an induration or rigidity of this texture,—an effect probably of very slow inflammatory action, sometimes arising from local injury, and not unfrequently without any assignable cause." (pp. 311, 12.)

This latter form is very curious, and I believe entirely undescribed, nor does it readily admit of solution. The former kind seems to me very similar to the brawny condition above mentioned.—J. F. S.]

85. *Symptomatic pseudo-erysipelas* is distinguished from the *idiopathic* or *common* inflammation of the skin produced by irritation; the inflammatory redness is not so distinctly spread; at some little spots it is more intense, here and there inclining to violet; the affected part is less hot, more doughy, sometimes also hard and knotty, and often at the very beginning of the disease, distinctly fluctuating to the touch. The patient does not complain of such burning, but of a gnawing or beating pain, not proportioned to the degree of inflammation, and situated deeply in the limb. The swelling also bears no proportion to the degree of inflammation, but is in direct relation to the pain. Painful and knotty hardening of the skin frequently precedes its inflammation. When the inflammation has taken place, it always spreads farther, usually, however, more slow than quick, creeping, as it were, towards the affected parts. The ordinary means of resolution are of little use; in most cases, the disease is chronic, and single spots are often observed, which suddenly become more sunken, more or less distinctly fluctuating, mortified or destroyed in some way or other. All the external causes which could have given rise to ordinary inflammation of the skin are deficient also at the beginning of the disease.

86. The etiology of pseudo-erysipelas is clear from what has been already said of its several kinds. In reference to the necrotic hardening of the cellular tissue, which is the most usual cause of pseudo-erysipelas, it must

be remarked that, although its origin is in many cases obscure, yet a peculiar state of atmosphere, specially the operation of severe cold and a certain change of temperature, must contribute much to it. Hence this disease occurs more frequently in winter and in the coldest months, than at any other time of the year, more frequently in weakly people and on the lower limbs, more commonly in advanced age and in the male sex.

87. The *Treatment* of simple erysipelas requires especially action on the biliary and cutaneous systems. Emetics have generally here the best effect if employed early, and cannot be replaced by purgatives. If after their operation the fever continue, cooling acid purgatives with suitable antiphlogistic diet must be employed. Not until the fever has entirely or for the most part subsided and no further indication for depletory remedies exists, can sudorifics alone be relied on. Only if the erysipelas, especially on the face, be accompanied with high inflammatory fever, the head thereby attacked, the erysipelatous parts swollen, burning, and painful, accompanied with confusion and determination of blood to the head, should blood-letting or bleeding with leeches behind the ears be employed before the use of emetics, and at the same time the blood should be withdrawn from the head by warm foot-bathing, mustard poultices upon the calves of the legs, and so on. It is always, however, to be remembered, that erysipelas, even when connected with inflammatory fever, will not bear the same active antiphlogistic treatment as other inflammations, and is specially prone to return after any exhaustion.

[Two very different plans of constitutionally treating erysipelas are employed in this country, and, curious as it may appear to be, with success. The old method, still largely practised, is that on the antiphlogistic plan, first clearing the bowels, and then employing salines and antimonials; and, when the inflammatory action has subsided, administering gentle tonics, as tincture of calumba and the like. This treatment, which formerly I have seen constantly practised, and to which I have been personally, often in my youth, subjected, was generally very successful, and is, by many practitioners, still considered the best. The second mode is directly the reverse, and was, I believe, first introduced, fifteen or twenty years since, by my friend and colleague, Dr. WILLIAMS. It consists in the entire reliance on wine (port wine usually) given often to the amount of eight and twelve ounces a day, varying according to the age and condition of the patient's constitution, but without any consideration of the stage of the disease. And this practice has certainly been very successful, and is at our hospital now almost invariably followed. I prefer, if the case come under my care early, besides administering a dose of calomel and rhubarb, (which should never, under any circumstances, be omitted,) to give some saline and antimonial for twenty-four hours; rarely beyond that time do I defer giving the wine, the effect of which in checking the progress of the erysipelas is, generally, soon very decided. Bleeding, either from the arm or by leeches from the head, is, I believe, very unadvisable. The disease almost invariably occurs in constitutions without power, and therefore bleeding favours rather than diminishes it.—J. F. S.]

88. The *Local Treatment* of true erysipelas has no other object than to defend the diseased part against external injury, which may be effected by the use of dry warmth, by bags of camomile and elder flowers, by warm flannels, and so on. All moist, especially wet or greasy remedies, are injurious, as they repel the erysipelas, or produce œdematous swelling of the part. If, after the fever and swelling have for the most part ceased, there remains an œdematous, colourless swelling, the herb bag must be smeared with camphor, or the swelling covered with green-oil cloth, and swathing of the part made use of. According to RUST, only the vesicular erysipelas and its varieties, especially if they exhibit a more chronic than acute course, require the application of moist warmth in a proper vehicle, for which purpose GOULARD's lead wash with a small addition

of laudanum is best. If the erysipelas run into ulceration or gangrene, attention must be paid to giving free escape to the ichor; the general and local treatment must be regulated, as before mentioned, according to the character of the fever, and the rules given in reference to abscess and gangrene, and clearance of the bowels, must be especially remembered.

[The local treatment of erysipelas is very simple; warm or cold washes, as may be most agreeable to the patient's feelings, consisting of water with a little spirits of wine, are best, and I think preferable to either warm or cold lead wash, which renders the cuticle harsh and unyielding.

If there be much tension of the skin, the practice recommmended by DOBSON of making a dozen or twenty punctures with the point of a lancet is very beneficial, and agreeably relieves the hide-bound sensation which the patient feels.—J. F. S.]

89. In *idiopathic erysipelas* the treatment must be guided according to the degree of the inflammation. General antiphlogistic treatment is rarely necessary in this case; usually the application of leeches and of cold water or lead wash are sufficient for resolution.

[Leeches should never, under any circumstances, be applied locally, as the irritation resulting from their use itself frequently excites erysipelas or rather erythema. If absolutely requisite, puncture with the lancet is to be employed.—J. F. S.]

90. In *erythema consensuale* the treatment varies according to its original cause. If it depend on the tension of aponeurotic expansions, incisions, warm bathing, friction with mercurial ointment, warm fomentations and poultices must be applied. If the erysipelas appears only as a reflection of deeper disease of the periosteum, of the tendons, or of cellular tissue, so long as the disease continues purely inflammatory, abstraction of blood, leeching, applications of cold lead wash and free mercurial friction, and, in metastasis especially, mercurial laxatives and warm aromatic fomentations, must be used; in gastric symptoms, with loaded tongue, heartburn and the like, a vomit should be first given, by which principally the course of the disease is rendered less severe. But, if gangrene or ulceration have occurred in the deeper parts, and there appear a spot particularly discoloured or fluctuating, it must be opened and the wound dilated with the blunt-ended bistoury upon the finger in every direction where the destruction of the cellular tissue has occurred, in order to discharge the pent-up ichor and the often large pieces of completely dead cellular tissue. The further treatment consists in supporting nature to throw off the destroyed parts, to sustain the sinking powers, and to produce good suppuration. According to RUST, there may be applied locally bark, camphor, myrrh, charcoal, camomile flowers, turpentine oil, camphorated spirit, pyroligneous acid, spirituous aromatic fomentations, and so on; internally, powerful tonic remedies are to be used in connexion with mineral acids, and, if thereby a good suppuration is produced, the healing may be aided by the application of a moderately compressing bandage. I have, however, noticed, that under this stimulating local treatment, the destruction and unhealthy suppuration as well as the general irritation have increased, and that by the use of warm fomentations and a suitable general treatment improvement has been much more quickly produced; I, therefore, only use warm applications locally. In great hardening of the skin and of the underlying cellular tissue, I have always effected a perfect resolution by mercurial infriction and malt baths.

[Neither leeches, cold washes, nor mercurial friction are, according to my experience, of any material advantage, and therefore hurtful, as causing waste of time. The best

local treatment, and which I almost invariably adopt, is, when the skin is tense, shining, and deep red, to make several incisions, according to the extent of the disease, from an inch and a half to three inches in length, which I think preferable to very long cuts, just through the skin into the cellular tissue, which should be so disposed that every four should have interposed between them a sort of diamond-like space, and thus, when several cuts are made, the skin has a net-like appearance, and yields in every possible direction. The object is not to obtain blood, which, indeed, I generally endeavour to avoid by bathing for a few minutes with cold water, if there be any disposition to bleeding, but to allow the cells of the cellular tissue to empty themselves of the fluid with which they are loaded, the effect of which is, that the skin, being further relieved of tension, is less likely to slough, and the tissue itself being no longer squeezed by the effused serum, the blood passes freely through its capillary vessels, and its life is preserved, instead of it becoming strangulated. If the tension be not sufficiently relieved, or if the disease be continued up the limb, it will be necessary to make additional cuts from day to day, which is the only chance we have, that I am aware of, to prevent the death of the cellular tissue, and it each time relieves the patient's sufferings most remarkably. In one instance of a man who had inflammation of the cellular tissue of the back of the hand, resulting from a strain, and which travelled up to the chest, I made about thirty cuts, mostly three inches in length each; during the course of the week, nearly the whole cellular tissue of the arm sloughed; but he completely recovered, his arm, however, closely resembling a piece of scored pork.

In these cases brandy, wine, porter, general good feeding, and humouring the appetite, are absolutely necessary, and infinitely preferable to medicine, which should be restricted to an opiate, or an occasional dose of castor oil, as needed.—J. F. S.]

91. In the treatment of the various kinds of erysipelas, we have given the treatment proper for each, and which has been proved by experience. The opinions, however, of the most distinguished physicians differ from each other in many important points on this subject. Thus the incisions should only be made in pseudo-erysipelas, and of the suitable length and depth, according to RUST, DUPUYTREN and LAWRENCE; while, according to HUTCHISON (*a*), they should be made early and in considerable numbers; but DOBSON (*b*) employs numerous punctures with a lancet in all kinds of erysipelas and on all parts of the body. In pseudo-erysipelas DUPUYTREN (*c*) professes, in some cases, to have effected a satisfactory resolution by blistering the diseased part: he, however, considers this remedy as doubtful, as in other cases he noticed deterioration and sloughs occurring after its use. But, in all cases of common erysipelas, if the tongue be moist and little red, the skin moderately hot, and slight general reaction connected with the local inflammation, he considers the suppuration produced by one or more blisters upon the inflamed part as the best mode of effecting resolution. Some (*d*) would arrest the extension by the application of a blister at the margin of the erysipelas; but others (*e*) entirely reject their use. BRETONNEAU (*f*) and VELPEAU (*g*) have had the happiest results from moderate compression of a limb attacked with inflammation, even when the transition to suppuration seemed unavoidable and all other remedies had failed. LAWRENCE and DUNCAN have, on the contrary, observed bad effects resulting from this practice (*h*).

[Another mode of attempting to check the spread of erysipelas, is that of enclosing it, if small, within a space bounded by a belt, a quarter or half an inch wide, made on the skin with nitrate of silver; or, if a limb be affected, by gartering it in the same way

(*a*) Case of Erysipelas, with Remarks; in Med.-Chir. Trans., vol. xiv. p. 213.

(*b*) On Treatment of Erysipelas by Punctures; in Med.-Chir. Trans., vol. xiv. p. 206.

(*c*) DUPUYTREN, as above, p. 322. OLIVET, Thèse, de l'Erysipèle Phlegmoneux, p. 30.

(*d*) ROCHE et SANSON, Nouveaux Elémens de Pathologie Medico-Chirurgicale, vol. i. p. 352. LAWRENCE, as above, p. 63.

(*e*) RAYER, Traité des Maladies de la Peau, p. 125.

(*f*) Sur l'Utilité de la Compression dans les Inflammations Idiopathiques de la Peau. Par., 1815.

(*g*) Mémoire sur l'emploi du Bandage Compressif dans le Traitement de l'Erysipèle Phlegmoneux, de la Brûlure et des plusieurs autres inflammations aiguës des membres; in Archives Générales de Médecine, Juin, 1826, p. 192.

(*h*) LAWRENCE, as above.

with the nitrate of silver some inches above. I have sometimes seen the erysipelas extend up to the belt and there stop; at other times I have observed it move on without having met with any check. I am therefore doubtful of the efficiency of the nitrate of silver; but, if used, it should be carefully applied, even to blistering the skin, otherwise it is certainly useless.—J. F. S.]

92. As various also are the opinions as to erysipelas consequent on wounds, (*Erysipelas traumaticum*,) in which the most opposite fomentations, blisters, incisions and scarifications, cauterization with the red-hot iron, (LARREY,) antiphlogistic treatment, emetics, and so on, have been recommended. If the above-described different kinds of erysipelas and pseudo-erysipelas be borne in mind, and, if it be remembered that the traumatic erysipelas, which in four or five days accompanies wounds, is produced by different causes, as too great irritation of the wound by improper bandaging, foreign bodies, the application of greasy, too stimulating or too hot softening remedies, cold moist air, a bruised and torn condition of the wounded part, wounds of fibrous structures, gastro-biliary affections, mental excitement, improper food, and the like, it may be easily perceived, how a proper observation of the various causes can alone prevent a merely routine treatment of so important a disease (*a*).

II.—OF BURNS.

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93. *Burns* (*Combustiones*, *Ambustiones*, Lat.; *Verbrennungen*, Germ.; *Brûlures*, Fr.) are produced by fire or heated substances touching our bodies. The action of caustic substances, especially of the concentrated mineral acids, corresponds precisely with that of fire. According to the degree of heat, in fluids therefore according to their consistence and capacity for heat, according to the duration of the contact and the delicacy of the part touched, different degrees of burns are produced, which may be thus distinguished: 1. *as superficial inflammation* (*Erythema*;) 2. *as more*

(*a*) Compare LARREY, Clinique Chirurgicale, vol. i. p. 21; BALLING as above.

severe inflammation with rising of the cuticle into blisters (Vesication;) 3. *more deeply penetrating, higher inflammation, with the destruction of the cuticle and of the mucous net;* 4. *gangrenous destruction at different parts and to various depths.*

Degrees of burns are variously distinguished, as they are considered not merely as to their intensity, but also with reference to their spreading into deeper parts. Many point out but three degrees. DUPUYTREN has described six; of which the latter, however, only differ in proportion as the gangrenous destruction is more or less deep, or involves the whole bulk of the limb. The four above-mentioned degrees are based on the corresponding steps of inflammation, viz., the erythematous, exudative-inflammatory-vesicular, the phlegmono-suppurative and gangreno-sphacelous. According to the variety of causes producing burns are these degrees of burning frequently blended with each other; for instance, in burns with hot fluids.

94. The *first degree* of burn, arising from hot vapour, from the momentary or lengthened touch of a more or less hot body, produces a bright uncircumscribed redness of the skin, as in erysipelas, which for the moment disappears on pressure of the finger, without swelling, and is accompanied only with increased turgescences of the skin and a little pain. Febrile action only sets in if this degree of burn be much spread and in sensitive persons. The redness of the skin either disappears after some hours or days, when the cuticle scales off.

95. In the *second degree*, which is most commonly produced by hot fluids, the cuticle rises either at once or gradually into larger or smaller blisters, filled with clear or yellowish fluid, the redness and swelling of the skin is more distinct; the pain severe, burning; and, according to the degree of these appearances and the extent of the burn, do febrile symptoms set in. These blisters either shrivel together and dry, the fluid being absorbed and the skin thrown off, or, if they burst and are opened, the fluid is discharged, the blister falls together, dries, and after some days either a new cuticle is produced or the exposed part suppurates. The healing leaves no scar.

96. The *third degree* of burn is usually produced by the flame of fire or by the lengthened touch of hot bodies, especially of hot fluids, and is characterized by gray, yellowish, or brown spots, which are thin and soft, insensible to light pressure, but are painful if the pressure be increased; at the same time generally appear blisters full of brownish or bloody fluid; the surrounding parts are very red and much swollen. The general reaction corresponds to the degree of the inflammation. After six or eight days, and frequently later, the remains of the destroyed cuticle and mucous net are thrown off, and the cure is effected by granulations and the formation of a white glossy scar.

97. In the *fourth degree* of burn the destruction penetrates either through the entire thickness of the skin and cellular tissue, or deeper into and through the muscles to the bone, or the whole part is destroyed and charred. This degree is produced by long contact with fire, red hot or molten metals, boiling fluids. The sloughs differ in thickness, are completely insensible; soft, gray, or yellow if produced by hot fluids; brown or black, dry, hard, and sounding when struck, if caused by fire or dry hot bodies. In the immediate neighbourhood of these sloughs the skin is drawn into radiating folds; the surrounding parts are extremely red and swollen, very painful, and frequently beset with blisters. The slough is thrown off by the suppuration which takes place around it, and a more or less deep suppurating space is produced, which commonly has a

much larger extent than the slough, because in consequence of the severe inflammation its immediate belt is destroyed by gangrene. The granulations most usually are developed very quickly and luxuriantly, the edges quickly draw together, and shapeless, hard, contracted, tough scars are produced, whereby the direction and motion of the part is often changed and impeded, and the latter even perfectly destroyed. After the throwing off of a part which has been entirely charred, a more or less uneven stump is produced.

98. More or less severe symptoms ensue according to the different degree and extent of the burn, according to the importance of the burnt part, and the constitution of the patient, and not merely does the degree, but also the extent of the burn, determine its danger. In the first two degrees the inflammation is easily resolved, and only if it affects a large extent of the body, and still more in the higher degrees, does febrile reaction set in, when, on account of the disturbed functions of the skin and the changed relations between the external and internal skin, the mucous membrane of the intestines is quickly affected, and uneasiness, loss of sleep red dry tongue, nausea, vomiting, high nervous excitement, delirium, and the like come on. From the severity of the pain cramps and convulsions occur, especially in sensitive persons. In extensive burns death may ensue rather suddenly from the greatness of the pain, from the quick stopping of the functions of the skin, from the excessive flow of blood to the internal parts where on dissection either no internal derangement is seen, or where a gorging of the brain and mucous membranes with blood and even effusion into their cavities is observed ; or from the severity of the fever, especially if accompanied with inflammation of internal parts, of the stomach intestines, brain, more rarely of the lungs and of the pericardium ; or from the very copious and continued suppuration, by which the powers are exhausted. The production of unsightly hard scars, or the growing together of neighbouring parts, may cause disturbance or complete stoppage of their functions.

[Burns, from whatever cause, are generally more dangerous than scalds, as they are rarely unattended with destruction of the skin and subjacent parts, whilst, on the contrary, scalds more usually produce only vesication. If, however, a person be completely immersed in boiling water, even for two or three minutes, of which I once saw a frightful instance, of a dyer who fell into his copper, he will be destroyed in ten or fifteen minutes. But I have several times, on the contrary, seen persons, whose entire surface has been charred by fire, live for many hours. This remarkable difference may, perhaps, be accounted for by presuming that the hot water, passing through the mouth and nostrils into the pharynx, causes speedy effusion into the loose cellular tissue connecting the skin with the laryngeal cartilages, and so, by narrowing and closing up the aperture of the windpipe, producing suffocation.

Both burns and scalds, however, are dangerous, more in reference to the part which they attack, than the extent of surface they injure; thus, scalds or burns on the chest and belly especially are far more dangerous than on the limbs, although the injured part be twice or thrice as extensive; and children who are burnt or scalded on the chest most commonly die in two or three days after the accident; in a few instances they may live a week, but they rarely ever recover. I recollect only a single instance of recovery, after severe burn on the trunk, in a child about six years old, in whom the whole front of the belly and flanks were burnt and a considerable part of the skin destroyed. I do not recollect to have observed convulsions in these severe cases, as mentioned by our author and other writers; but, if they be fatal in a few hours, the patient generally, almost at once, drops into a state of stupor from which he never after rouses; and examination after death shows the brain loaded with blood, or, if life be prolonged, effusion of serum is observed on the membranes, and in the cavities of the brain, and, less commonly, also in the serous bags of the chest.—J. F. S.]

99. The slighter degrees of burn require merely the application of cold water, or the dipping the part in cold water; all other of the prescribed remedies, lead wash and so on, act only by their coldness. If fever be present the internal use of antiphlogistic remedies and a suitable diet must be combined with the local treatment. If the cuticle have been raised into blisters, they should be opened with a fine lancet, without removing the skin, so that the contained fluid may escape. If they be small, they often, under the use of cold, fall together and dry. If the part be deprived of its cuticle, generally it will not bear the cold application, which irritates, and increases the pain; but simple, mild, soothing remedies, mucilaginous, mild poultices or fomentations, a liniment of pure oil and yolk of egg, fresh butter, and other mild salves may be spread on pieces of soft linen, which should be applied over the burnt part, and often changed, or they should be frequently sprinkled with the remedies, to prevent their drying and sticking, so as to soften and cool by their frequent renewal. Cold is always to be applied to the neighbourhood of the parts deprived of their cuticle. When suppuration is established, and the extreme sensibility of the affected part reduced by the use of mild remedies, astringent and drying applications are to be gradually had recourse to: linseed oil, with lime water, zinc ointment, and so on. Lead ointment is said to produce ugly ill-shapen scars, which, however, I have not observed. If much proud flesh occur, it must be kept down with nitrate of silver. If mortification be produced at the instant of the burning, cold application, or, if the parts are very sensitive on account of the destruction of the cuticle, merely softening and soothing applications must be used till the slough is thrown off by the suppuration, when the remedies aforesaid must be employed. Sloughing rarely extends in this case, if not accompanied by deterioration of the juices. In other respects its treatment, even when resulting from the inflammation depending on the burn, is to be after the same general rules laid down for gangrene.

The remedies especially recommended for burns are very various, and in part completely contrary to each other in their operation. 1. Popular remedies, such as poultices of scraped potato, apples, moist earth, and so on, which are cooling by their proper renewal. 2. Applications of spirituous fluids, æther, alcohol, brandy and so on, if used cold, act also coolingly by quick evaporation; if warm, they can only act as counter irritants: but all burns in which the *rete cutaneum* is exposed must be protected from irritation. 3. The burnt part is brought near to the fire immediately after the burning. 4. Wraps, by which the burnt parts are kept perfectly closed against external influences. The overlaying of fine cotton or wadding, to be kept moderately tight with bandages till it falls off. If blisters are present, they must be first punctured. The strewing with flour and bandaging with dry linen. If pain recur, the linen should be removed and the flouring repeated again and again till it is a quarter or half an inch thick. In very severe burns, after a fortnight, a fourth of calamine powder is added to the flour and applied moist. Covering with chalk, smearing with amber-varnish or tragacanth mucilage spread on blotting paper or fine linen. The watery solution of lunar caustic, recommended by Fricke, operates in a similar way, by defending the sensitive surface and furnishing it with a covering beneath which speedy healing takes place. In like manner is the operation of kreosote to be explained, from which, when diluted with water, or mixed with grease as a salve, I have frequently observed the best consequences. 5. Various ointments for burns, consisting of fat, butter, wax, cream, and the like. Larrey forbids all cold and cooling remedies, and uses saffron ointment and ointment of styrax. 6. Solution of chlorate of lime, wherewith the bandage is to be frequently moistened during the day, causes a slight itching for about ten minutes, and is, according to Lisfranc, useful in slight degrees of burn, producing new skin in twenty-four hours; in higher degrees the suppuration is diminished and improved.

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